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# IL-28 AIRCRAFT RADIO EQUIPMENT

## Volume V Part I

## DESCRIPTION AND INSTRUCTION FOR USE

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# IL-28 AIRCRAFT RADIO-EQUIPMENT VOLUME V. PART I. DESCRIPTION AND INSTRUCTION FOR USE

PRAGUE 1959

# AIRCRAFT IL-28

Radio equipment - Volume V.- Part 1

Description and instruction for use .

## RADIO EQUIPMENT.

### General.

The radio sets used in the aircraft will provide two-way radiotelephone and radiotelegraph communication between aircraft in flight and between aircraft and aerodrome stations. Using these sets the aircraft may be lead by broadcasting stations, and so approach the home base. It can determine exact altitude above the ground, it also cal land on aerodromes without external visibility. The radio sets answer with codes automatically to interrogations of identification stations. They enable bombarding during instrument flight conditions. These sets provide telephone communication between crew members too.

To meet all these requirements, the aircraft is equipped with following radio sets /Fig. 1/.

1. Idaison Radio Set RSB-5
2. Command Radio Set RSIU-3M
3. Radio-Compass ARK-5
4. Radio-Altimeter for low altitudes RV-2
5. Radio-Altimeter for high altitudes RV-10
6. Instrument landing equipment consisting of:
   a/ localizer receiver KRP-F
   b/ glide-path receiver GRP-2
   c/ marker beacon receiving equipment MRP-48 P
   d/ distance measuring equipment SD-1
7. Airborne radar responder SRO
8. Blind bombing a navigation equipment PSBN-M
9. Communication system type SPY-5
10. "Siren 2".

List of antennas belonging to aircraft radio sets is in the table 1. Primary source of radio-equipment in the aircraft is done by the electrical DC-system, with nominal voltage 27b ± 10%. Direct current high voltage and different voltages of alternate current required for radio equipment are obtained from dynamotors and inverters.

Radio sets RV-10, RSIU-3M and ARK-5 are supplied from alternating current main bus-bar to which the inverters MA-500 and MA-250 are connected.

Fig. No 1: Diagram of location of the radio-equipment.

To Fig. No 1: Diagram of location of the radio equipment.

1/- H.f. blocks /BP-2/ and /BP-3/ of the /RSB-5/, 2/- the power element /RSB-5/, 3/- the antenna element /RSB-5/, 4/- control desk /RSB-5/, 5/- current indicator /RSB-5/, 6/- receiver /US-F/ /RSB-5/, 7/- converter /RU-11 AM/ /RSB-5/, 8/- transmitter /RSIU-3/, 9/- receiver /RSIU-3/, 10/- antenna /ASHS/ /RSIU-3/, 11/- rectifier /RSIU-3/, 12/- control desk /RSIU-3/, 13/- navigator's control desk /ARK-5/, 14/- pilot's control desk /ARK-5/, 15/- pilot's indicator /ARK-5/, 16/- navigator's indicator /ARK-5/, 17/- antenna /ARK-5/, 18/- frame inside fuselage /ARK-5/, 19/- receiver /ARK-5/, 20/- transceiver /RV-2/, 21/- converter /RU-11AM/ /RV-2/, 22/- antenna /RV-2/, 23/- indicator /RV-2/, 24/- transceiver /RV-10/, 25/- indicator /RV-10/, 26/- antenna /RV-10/, 27/- pilot's telephone set /SPU-5/, 28/- navigator's telephone set /SPU-5/, 29/- gunner's telephone set /SPU-5/, 30/- amplifier /SPU-5/, 31/- converter /RU-11 AM/ /SPU-5/, 32/- transceiver /SRO/, 33/- antenna /SRO/, 34/- code board /SRO/, 35/- detonator button /SRO/, 36/- inertia switch /SRO/, 37/- antenna /MRP-48p/, 38/- receiver /MRP-48p/, 39/- glide path receiver /GRP-2/, 40/- localizer receiver /KRP-F/, 41/- signalling block /MRP-48p/, 42/- control desk /M-50/, 43/- indicator /PSP-48/, 44/- glide path antenna, 45/- localizer antenna, 46/- matching device, 47/- indicator /SD-1/, 48/- control desk /SD-1/, 49/- receiver /SD-1/, 50/- transmitter /SD-1/, 51/- converter /MA-250/ /SD-1/, 52/- antennas /SD-1/, 53/- responder /PSBN-M/, 54/- supply block /PSBN-M/, 55/- azimuthal stabilization block /PSBN-M/, 56/- equivalent of indicator tube /PSBN-M/, 57/- PPI-tube /PSBN-M/, 58/- calculator /PSBN-M/, 59/- transmitter /PSBN-M/, 60/- board of sectorsearching /PSBN-M/, 61/- antenna /PSBN-M/, 62/- reverting relay /PSBN-M/, 63/- converter control board /PSBN-M/, 64/- converter MA-1500K /PSBN-M/, 65/- communication block with /OPB-6SP/ /PSBN-M/, 67/- air suction /PSBN-M/, 68/- sight /OPB-6SP//PSBN-M/, 69/- antenna /PSB-5/.

## 1. Liaison Radio Set RSB-5.

### General.

The radio-set RSB-5 /Fig. 2/, located in the aircraft and provided with two-way radiotelephone and radio-telegraph communications between aircraft and between ground stations and aircrafts in flight. Radio Set RSB-5 consists of transmitting and receiving equipment. The transmitting equipment consists of two radio-frequency units, one power unit with dynamotor RUK-3II3, antenna unit with crystal calibrator, remote control-box and in-

dicator. The receiving equipment comprises receiver US-5 with dynamotor RU-11AM. Transmitting equipment transmitts in frequency range from 2,15 MC to 12MC.

Receiving equipment may receive signals in frequency range from 175 kc to 12 MC.

Two-way radio-telephone and radio-telegraph communications using this radio set are accomplished by the air-gunner-radio operator, which also carries out any adjustment of the radio set during the flight.

Two-way radio-telephone communication may be accomplished also by the pilot. In its cockpit the press-to-transmitt button /on the control column/ is situated and a change-over switch

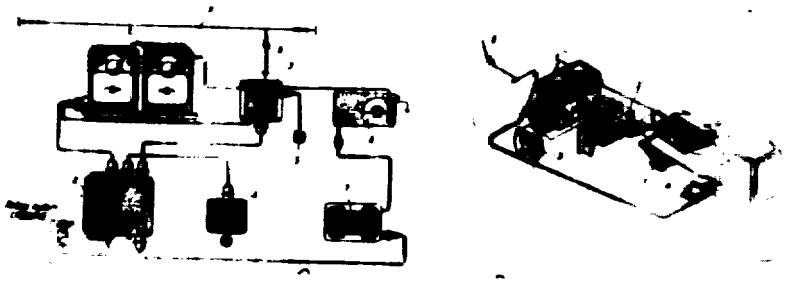


Fig. No.2: Diagram of connection and location of the blocks /RSB-5/.

1/- H.f. blocks, 2/- power element with converter /RUK-300B/, 3/- antenna element, 4/- control desk, 5/- tuning indicator, 6/- receiver /US-P/, 7/- converter /RU-11AM/, 8/- lead-through insulator, 9/- antenna.

"Command-Liaison" / on the trim control pannel/. From the pilot's cockpit it is not possible to change the communication frequency.

The navigator is able only to listen the communication. Radio Set operates on DC-voltage supplied from electrical system

to which it is connected through a circuit breaker AZS-50 located on the right hand panel of the air-gunner /radio-operator.

All units of this radio sets are located in the gunner's compartment.

Transmitter units are situated in hermetical gunner's compartment on a support fixed to the 42nd frame of fuselage. Mounting frame of units is positioned symetrically and secured to the support by pins. Transmitter units are fixed to the mounting by means of knurled nuts and lugs and it is therefore easy to remove them. The front panels of unit are good accessible on the ground and during the flight.

Receiver US-P is located on the right table of the gunner/ radio operator. To obtain a satisfactory control of adjusting knobs, the receiver is declined 30 degrees from the aircraft axis. Receiver is fixed to a shock mounting secured to the table. Power unit is secured to a support on the right hand side of the aircraft between the 42nd and 43rd fuselage frame.

Antenna unit is located on the left side of the aircraft in the gunner's compartement on the 42nd fuselage frame on a mounting fixed to the support by means of pins.

Radio control box and antenna current indicator are located on the support on the left side of gunner's compartement on the 45th fuselage frame.

Further in the gunner's compartement a pocket with tuning tables and spare valves box is located.

All units of radio-set are interconnected with double screened cables. Each cable is terminated with a plug connected to corresponding socket of an other radio set unit. To make the exploitation easy, each socket is provided with inscription to

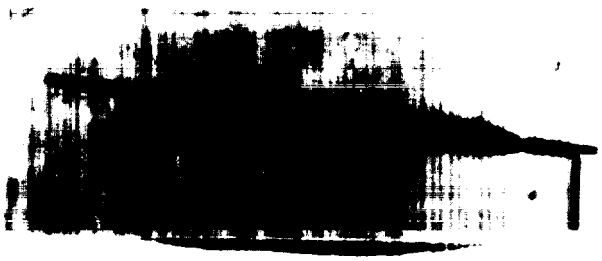


Fig. No.3: Antenna insulator.

Fig. No.4:

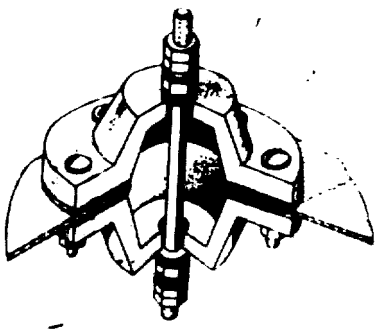


Fig. No.5:

which the plugs secure to the support and

Contact sur l to obtain reliable contact between clamps and structure for cable shield bonding purposes. Unsatisfactory contact with aircraft structure

increases radio disturbances.

Antenna element of liaison radio set RSB-5 is a fix T-antenna hanged with the antenna of ARK-5 between the fin and pilot's cockpit /fuselage frame 11/. The length of effective part of antenna is 8,25 metres. A steel lace of 2 millimetres diametre is used for the antenna. The upper part of antenna is fixed to a special hook on the fin. To diminish the shocks in antenna during the landing and other over-loadings, a spring emorticator is inserted in the effective part of antenna. Antenna is insulated using special insulators.

To prevent icing of antenna during the flight, the antenna insulator has a special metal cone /Fig.3/. A steel lace of the same type /2 mm dia./ is used for the antenna lead to the radio-operator's compartement. A ceramic insulator leading the antenna through the aircraft surface is located on the left side of fuselage /above its axis/ between the 39th and 40th fuselage frame. To prevent icing of this insulator, a special filtre-glass protector is used /Fig.4/. The first insulator is connected with the hermetically sealed insulator of compartement using a bare copper wire of 1,5 mm dia. Special ceramic beads are strung on the wire. Near the 40th fuselage frame the antenna secured to the support insulator. A plate insulator /Fig.5/ is used to lead the antenna in-to the gunner's hermetical compartement. Copper wire with ceramic beads and chlorvinil hose fixed to support insulators is used for antenna that leads in to the cabin.

Transmitting equipment of liaison radio set.

Transmitter.

Transmitter of radio set RSB-5 consists of two radio-frequency units BP-2 and BP-3 /Fig. 7/. Schematically and constructively the both units are alike, each being a complete three-stage radio-frequency generator.

First stage is the master-oscillator.

Second stage is the buffer circuit operating as an amplifier and frequency doubler.

Third stage is the output power amplifier.

The radio-frequency unit contains also a rectifier for the output stage tuning indicator.

In the front panels of radio-frequency units are situated the tuning controls.

In the centre of front panel there is located the range selector switch which switches the buffer-stage coil and changes in the same time the numbers of tuning dial located just above the range selector switch. By turning the knob "Frequency" the scale is turned and the frequency changed.

After the frequency has been adjusted, the frequency control may be locked with a lock-ring under the control knob, in the right lower edge of front panel.

In the upper part of front panel there is located a knob bearing inscription "Antena tuning". This knob moves an inductor tuning the output circuit. The control knob is locked by a wing nut.

From centre of panel to the left there is control knob called "Coupling coarse", switching the fixed capacitors of output circuit.

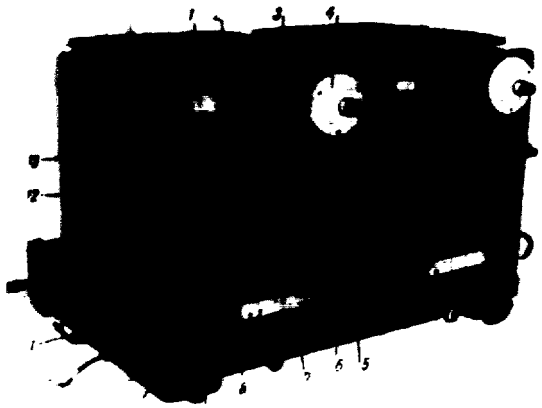


Fig.No 6: H.f. block of the radio station /RSB-5/.

1/- measuring instrument, 2/- scale of the block, 3/- antenna tuning knob, 4/- terminal /B/, 5/- switch /PR-PC/, 6/- transmitter tuning knob, 7/- band switch, 8/- table of positions of knobs of block, 9/- key without fixed position, 10/- hook, 11/- exact tuning knob, 12/- rough tuning knob, 13/- measuring instrument switch.

Bellow this knob is control knob called "Coupling fine" locking device of variable capacitor of output circuit and switch of capacitor connected in parallel with the first.

In the upper right edge of front panel there is located a binding post with inscription "B" for connecting the output circuit to the antenna unit. From the centre of the panel to the right there is located a tumbler switch PR-PG selecting either parallel or series connection of output circuit.

In the lower left edge of front panel a key /having no blocking/ which switches on the transmitter for tuning is positioned.

In the left upper edge of front panel there is a indicator with its selector switch.

In the lower part of front panel to the left and bellow the frequency control knob is a cover covering the master-oscillator frequency adjustment padding. On the label it is possible to record using a pencil to control knob positions.

On both sides of front panel near the bottom, handles for removing the transmitter from mounting are secured. Fasteners fix the radio-frequency units to the mounting. The mounting is fixed to a frame secured to the aircraft structure. On the mounting of units is situated a socket "T" for headset connection when tuning the transmitter, binding posts for connecting the counterpoise, socket for power unit cable plug and binding post "I" for connecting the antenna unit.

Four screens fasten the front panel to the chassis of the unit produced as a pressed aluminium box. On the top side of chassis covered with a case there are located details belonging on the whole to the output stage, i.e. valves, inductors etc.

Outline characteristics of transmitting equipment.

1. Frequency range
- unit BP-2 from 2,15 to 3,6 MC and from 4,3 to 7,2 MC
- unit BP-3 from 3,6 to 6 MC and from 7,2 to 12 MC,
2. Frequency setting accuracy
- using crystal calibrator ± 0,02 % of nominal frequency
- without use of crystal calibrator ± 0,09 % of nominal frequency
3. Transmitter output measured using dummy antenna
- telephone operation with 100 % output over 50 watts on frequency 2150 kc and over 90 watts on frequency 1200 kc
- telephone operation with 100 % output over 20 % of full

output when operated CW

- telephone operation with 25 % output over 20 % of telephone operation output
- telegraph /CW/ operation with 25 % output over 20 % of full output when operated CW.

4. Transmitter is able to operate continuously 30 minutes after turning on and it is able to operate permanently /maximum 10 hours/ when operated as follows:

5 minutes operation, 10 minutes pause.

5. Radio set contains a crystal calibrator for checking by aural zero beats any of frequencies marked on the frequency dials of units. It enables to obtain a frequency setting accuracy of 0,02%.

Without the use of crystal calibrator the frequency setting accuracy is about 0,09 %.

6. Frequency stability /frequency drift/ of transmitting equipment:

a/ caused by the warming up of the set after 5 minutes of operation better than 0,015 %

b/ caused by different destabilizing factors /change of input voltage in limits of ± 10%/, misadjusting of antenna circuit, switching from full output to reduced output /better than 0,004 % for any frequency/.

7. Transmitter may be radio-telephone and telegraph operator with reduced output corresponding about 25 % of full output.

8. Modulator of transmitter operates with laryngophone and produces 80 % modulation depth with distrotion factor not exceeding 10 % and 100 % modulation depth with distortion factor not exceeding 15 %.

9. Over-all frequency response of transmitter is flat from 300 cps to 3000 cps with high frequency cutt-dawn at 3000 cps.

10. Transmitter is able to operate with full output up to altitude 10.000 metres and with reduced output /to 25 %/ up to altitude 14.000 metres.

11. Using supplementary crystal any frequency in range may be controled by crystal.

12. Primary source is obtained from the 28 volt d-c electrical system of aircraft. The power drain at maximum power output when CW-operated does not exceed 800 watts.

13. Transmitter is equipped with radio-frequency guard device of telephone and telegraph operation /monitor/.

14. All radio set adjustments during the flight /switching from receive to transmitt, emission selection telephone-telegraph, transmitting units selection/ are remote controlled from radio control box by means of three tumbler switches and one selector switch located on the box.

Radio control box is combined with the telegraph key.

15. Transmitter of the radio-set enables a continuous for 30 minutes, at continuous engagement up to 10 hours. Cycles 5 minutes of operation, 10 minutes of interruption.

16. In the transmitting equipment following tube-types are used:

| | | |
|---|---|---|
| In radio-frequency unit | 411 | 2 pieces |
| | 471 | 1 piece |
| | 6SA7 | 1 piece |
| In modulator unit and monitor | 6H7 | 3 pieces |
| In crystal calibrator | 6SA7 | 4 pieces. |

P o w e r u n i t .

Power unit /Fig. 7/ contains supply circuit, modulator and commutator for both radio-frequency units. It consists of

a/ dynamotor RUK-300 B

b/ modulator

c/ tone generator with rectifier

d/ auxiliary circuits.

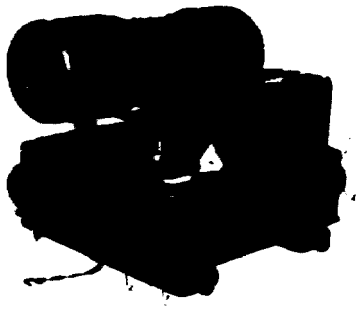


Fig. No 7: Power element.

1/- rotary converter /RUK-300B/, 2/- modulator, audio frequency generator and rectifier, 3/- laryngophone plug sockets, 4,7/- connectors for connecting cables, 5/- terminal for self-reception, 6/- high voltage fuse box.

Dynamotor RUK-300 B is the main high voltage supply of all units of transmitting equipment. Primary collector of dynamotor RUK-300 B is fed from d-c electrical system of the aircraft.

Output collectors of dynamotor are connected in series. Therefore is the dynamotor able to supply two voltages: 350 volts at 150 milliamps. and 1000 volts at 250 miliamps.

High voltage 1000 volts is used for supplying the plates of output stages of radio-frequency units.

Voltage 350 volts supplies other stages and circuits, for example screen grids of output stage. To diminish the undulation of voltage, both primary collector and output collector are blocked with capacitors.

Modulator circuit is a two stage audio frequency amplifier. It is designed for amplifying audio-frequencies originating from laryngophone. Amplified audio-frequencies are fed to the suppressor grids of output stages of radio-frequency units.

The tone generator with rectifier have negative voltages required in the transmitting equipment. Generator uses a 6H7 valve.

Tone generator uses the right section of triode and operates in the range between 0,5 and 1,2 kc.

Power unit is manufactured in form of a pressed aluminium box having on the top the dynamotor RUK-300 B.

On the right side of power unit box there are situated the cable sockets: socket of unit mounting cable, socket of radio control box cable and socket of antenna unit cable. On the left hand side of the power unit there are located the high voltage fuse box and sockets for connecting the main power cable and cable of dynamotor RU-11AM.

For grounding the unit, a counterpose binding post is installated.

The terminal "S" /side-tone/ is intended for connecting the output of receiver US-P to the monitor circuit.

The bottom of power unit is secured to the shock-absorbing frame by screws.

Inside the power unit box there are located parts belonging to the starting circuit of dynamotor RUK-300 B and also parts

belonging to the modulator, tone generator with rectifier and other auxiliary circuits.

Outline technical data of dynamotor is used in radio set RSB-5

| | RU-11AM | RUK-300 B |
|---|---|---|
| Output power, watts | 11 | 300 |
| Input voltage, volts | 26 | 26 |
| Output voltage, volts | 220-250 | 332-370 |
| | | 950-1060 |
| Current drain at nominal output load, amps | 1,4 | 19,4 |
| Nominal output current amps. | 0,05 | 0,15 |
| | | 0,25 |

## Antenna unit.

Antenna unit of radio set /Fig. 8/ is designed for switching the antenna from receiving to transmitting equipment. In addition to the antenna relay, the antenna unit contains also radio-frequency monitor /side-tone-circuit/ with output stage tuning indicator and crystal calibrator for frequency setting check and correction of unit dials after valves have been replaced.

Antenna unit is manufactured in form of a pressed aluminium box having on the front panel an insulator with binding post "A" for aircraft antenna connection, a binding post "B" for radio-frequency units connection, crystal calibrator selector switch, cover of crystal calibrator circuit, binding post "AP" for receiver input connection and binding post "S" of mixer grid of crystal calibrator.

On the bottom of box the socket of power unit cable, soc-

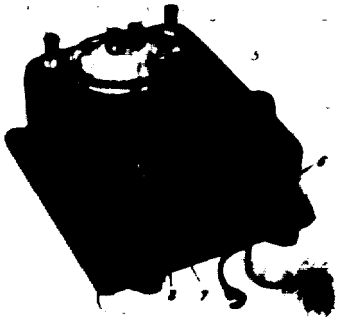


Fig. No 8: Antenna element of the radio station RSB-5.

1/- terminal C /S/, 2/- terminal /B/, 3/- terminal A, 4/- terminal /AP/, 5/- crystal calibrator switch, 6/- connecting cable connector, 7/- terminal, 8/- plug socket for connecting the indicating instrument.

ket indicator cable, couterpoise terminal and captive screws are located.

Inside the antenna unit box in its parts belonging to the antenna switch circuit, antenna relay, relay short-circuiting the receiver input, monitor amplifier valve 6H7 and load resistors of crystal calibrator are located.

Inside the lower part of antenna unit box component parts and valves 6A7 /fixer and crystal oscillator/ 200 kc generator, 40 kc generator, 10-20 kc generator of crystal calibrator are located.

## Radio Control.

Box /for transmitter control/.

Radio control box /Fig. 9/ is designed for remote control of transmitting equipment.

Radio control box is combined with telegraph key. It con-

'eins a "Receive-Transmit" switch, a tumber switch "C-Voic", power switch "25-100%" and transmitter units selector switch "1-2-3". Radio control box in the form of a pressed aluminium box parting on its top all required controls.

Fig. No 9: Control box of the transmitter.
1/- switch, 2/- power switch, 3/- switch Telegraph-Telephone, 4/- switch Receive-Transmit, 5/- telegraph key.

The telegraph key is mounted in the box.

Snap slides fasten the radio control box to the frame secured to a bracket beside the radio-operator's table.

To the right terminal screw of telegraph key a plate is secured, to which the wire of remote transmitter switch is connected. Wire connected to this plate leads through the box out to the press-to-transmit switch on the pilot's control column. The other terminal of this switch is connected to the positive main bus through a circuit breaker AZS-5 on the pilot's right hand panel.

T u r n i n g i n d i c a t o r .

The transmitting equipment has one indicator for all radio-frequency units. It is used for adjusting the transmitter and also for visual indication of radio set operation during the flight. The turning indicator is a direct current milliampermetre.

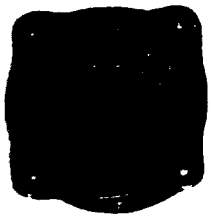


Fig. No 10: Tuning indicator of the RSB-5.

RECEIVING EQUIPMENT OF LIAISON RADIO-SET.

R e c e i v e r US-P.

US-P /Fig. 11/ is a multi-purpose superheterodyne receiver using six-volt serie tubes. It is employed for voice, tone and continuous wave reception.

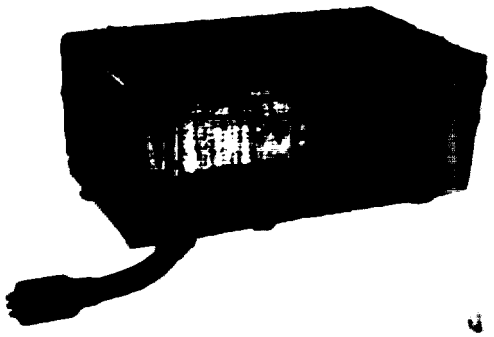


Fig. No 11: Receiver US-P.

Receiver consists of following stages:

1/ Radio-frequency amplifier using 6K7 tube

2/ Mixer using 6A7 /6SA7/ tube

3/ Local oscillator using 6K7 tube

4/ Intermediate-frequency amplifier suing 6K7 tube /two stages/

5/ Detector and AVC using 6X6O /6X6/ tube

6/ Studio frequency amplifier using 6K7 tube

7/ Beat frequency oscillator using 6K7 tube.

All main parts of the receiver are located on the horizontal aluminium chassis.

To the panel there is secured the front panel with adjusted controls.

An aluminium case covers the receiver.

On the front panel following controls are situated: coarse frequency setting control with inscription "N" /"Turning"/ and vernier "PN" for fine frequency seting, located in the centre of panel.

In the right lower edge of front panel there is located the terminal "A" for receiver antenna connection. To the left from it the volume control "RG" is located. To increase the audio-level turn this control knob in clockwise direction.

The range selector switch "D" is located to the left from the volume control. The range selector switch has five fixed positions corresponding to the five bands. In a row with this switch two switches are located. The upper switches on the automatic volume control when placed into "AVC" position, the lower switches in "CW" positions the beat frequency oscillator for reception of unmodulated telegraph signals.

To the left from the switches two sockets "T" for headset connection are located.

In the left lower edge of the front panel there is secured the main cable terminated with a plug.

In the laternal side a screw for ground connection is fixed Dynamotor RU-11AM is located beneath the right table of the gunner, radio-operator supplies power for plate and screen grid circuits of receiver.

Outline characteristics of receiving equipment.

Frequency range of receiver makes possible to receive signals on frequencies from 175 to 12 000 kc /1714-25 metres/ corresponding to fixed frequencies from number 7 to number 48. Frequency dial of the receiver is calibrated in kilocycles

The whole frequency range is divided into five bands as follows:

| | |
|---|---|
| 1st band | 175-350 kc |
| 2nd band | 375-875 kc |
| 3rd band | 900-2150 kc |
| 4th band | 2125-5000 kc |
| 5th band | 5000-12000 kc |

Dial accuracy on the 1st band ± 2,5 kc.

2nd band between 375 and 750 kc ± 3,5 kc
between 350 and 875 kc ± 0,5 %

3rd band between 900 and 1500 kc ± 7,5 kc
between 1500 and 2100 kc ± 0,5 %

4th and 5th band ± 0,5 %

After replacing the tubes, the dial accuracy may be 1,5 times worse.

Receiver sensitivity for telephone operation better than 10 microvolts /for internal noise output not exceeding 2 volts and output voltage equalling to 15 volts when loaded with two headset pairs/.

After replacing the tubes, the receiver sensitivity may be diminished to 15 microvolts.

Receiver sensitivity for telegraph operation better than 4 microvolts /for internal noise output not exceeding 10 volts and output voltage equalling to 15 volts when loaded with two headset pairs/.

During the duty the receiver sensitivity may progressively decrease to 17 microvolts for telephone operation and to 7 microvolts for telegraph operation.

Dynamotor RU-11 AM supplies required high voltage.

High voltage current drain of receiver does not exceed 0,6 amp. Total current drain of radio set when transmitting is about 20-25 amps when receiving it is about 4,3-4,5 amps.

COMMAND RADIO SET RSIU - 3 M .

The radio set RSIU-3 M /mark A/ /Fig.12/ will provide simpler two-way radio-telephone communication between aircraft in flight and between aircraft and ground stations. Operation takes place on crystal-controlled channels lying within the very high frequency range.

Radio set consists of the following component units:

1/ transmitter /unit A/ with mounting and shock-mounts
2/ receiver /unit B/ with mounting and shock mounts
3/ selenium rectifier /unit V/
4/ radio control box /unit P/
5/ set of crystal

5/ antenna AŠS-1

Transmitter and receiver are located on special shock absorbing mounting on the left side of pilot's cockpit between the sixth and eight frame of fuselage.

The mounting frame is fixed to special racks secured to the aircraft structure. Selenium rectifier is mounted on a special shock mounting secured to special racks on the floor of navigator's compartement between the third and fourth fuselage frame.

Unit A - Transmitter.

The transmitter may /Fig. 14/ operate permanently as follows:

two minutes of transmitting, two minutes of receiving. It also transmits 15 minutes without interruption. Transmitter output is 6 watts.

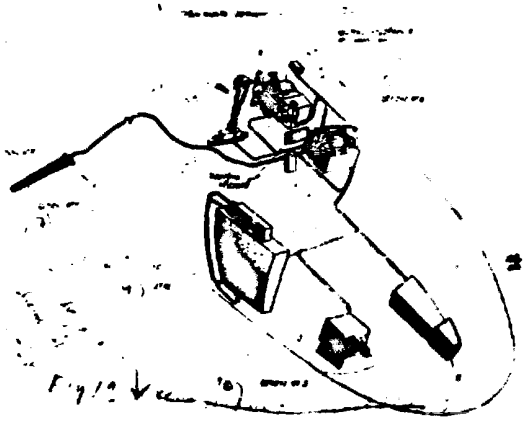


Fig. 12: Diagram of connection and location of the blocks of the RSIU-3 M.
1/- receiver, 2/- transmitter, 3/- rectifier, 4/- control desk, 5/- switch of command station, 6/- antenna, 7/- switch of radio station command liaison, 8/- button switch of radio station.

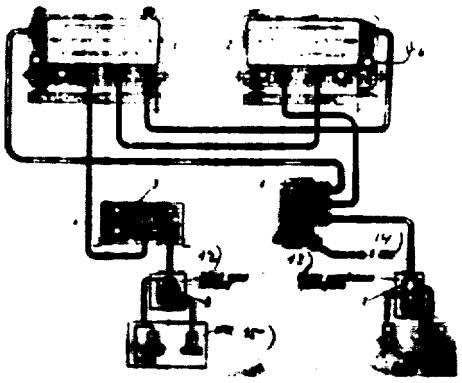


Fig.No.13: Diagram of connection and location of the blocks of the RSIU-3 M.

1/- left panel of pilot, 2/- trimmer control panel, 3/- steering wheel, 4/- rib No. 16, 5/- crystal boxes, 6/- rib No 11, 7/- rib No. 10, 8/- A.c. panel, 9/- CRSHCH, 10/- rib No.3, 11/- navigator's left panel, 12/- left pilot's panel, 13/- trimmer control panel, 14/- to SPU, 15/- CRSHCH.

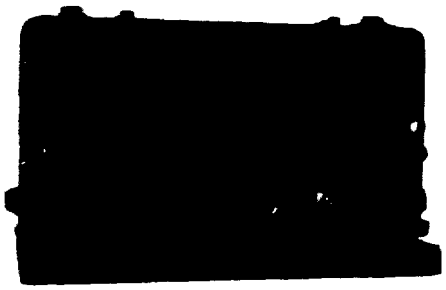


Fig. No 14: Transmitter RSIU-3 M.

The unit A is designed in form of a separate unit in cover case. For diminishing the vibration, the unit is located on a shock absorbing mounting with four shock mounts secured to the unit structure. Two screw-holders fasten the mounting to the mounting frame.

On the front panel of transmitter following parts are located: shifter mechanism for three knobs, patched motor, crystal selector switch, crystal sockets, cable sockets, antenna connector channel release button and ground terminal.

Unit B - receiver.

Unit B /Fig. 15/ is a 13-tube superheterodyne receiver.

Receiver sensitivity is about 10 microvolts.

Overall band width is about 100 kc. The receiver includes amplified automatic volume control maintaining, the headset level practically constant. A special electronical squelch suppresses the reception when no carrier of desired frequency is received and protects the operator against fatigue by the extraneous noise.

Squelch circuit is controlled with a switch located on the front of the panel.

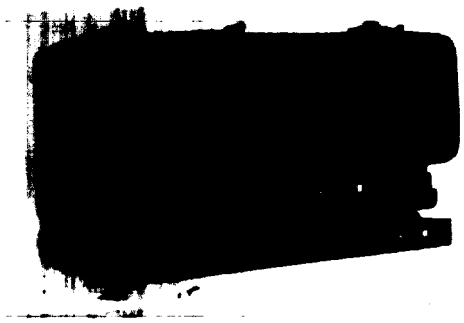


Fig. No 15: Receiver RSIU-3 M.

...eiver.

On the front panel of the receiver following parts are located: shafts mechanism for two knobs, ratched motor, crystal selector switch, crystal sockets, channel release button, tubel sockets, sensitivity control, squelch switch and ground terminal.

Unit V - Selenium Rectifier.

Unit V /Fig. 16/ consists of two selenium rectifiers. It is designed for rectifying the alternate current obtained from mains 400 cps.

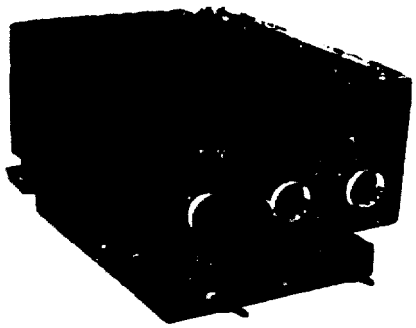


Fig. No 16: Rectifier RSIU-3 M.

Unit V is fixed to the mounting and mounting frame in the same manner as the units A and B.

Unit P - Radio Control Box.

Unit P /Fig. 17/ radio control box is constructed as separate unit and located on the left hand pilot's panel.

Radio control box is designed for radio set adjustment and selection of desired communication channel.

On the front panel four channel selector push buttons, volume control knob with stop and "1-2" switch covered with a panel are located.

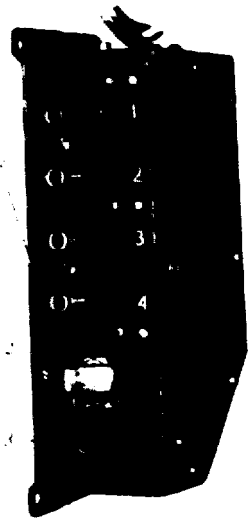



Fig. No 17: Control desk of the radio station RSIU-3 M.

1/- channel switch button, 2/- receiver-switching tumbler switch, 3/- volume control.

Unit P - Radio Control Box.

Beside each button on the front-panel, there is an opening. When selecting any channel, white mark covers the opening corresponding to the selected channel. On the radio control box there is located a channel release button. Four interconnecting cable sockets are also positioned on the box.

Outline Characteristics of Radio Set RSIU-3 M.

Radio set RSIU-3 M transmits and receives in the frequency range from to 150 MC /2-3 metres/. Crystal control ensures reliable communication without any adjustment during the flight.

The following table lists the approximative range of radio set RSIU-3M assuming that communication is taking place between and aircraft and ground station equipped with radio set type RAS-UKV.

| | | |
|---|---|---|
| Altitude of flight | 1000 metres | range 120 km |
| Altitude of flight | 2000 metres | range 160 km |
| Altitude of flight | 5000 metres | range 260 km |
| Altitude of flight | 10000 metres | range 350 km |

When communication is taking place between aircraft flying in altitude above 500 m, a range over 120 km may be expected.

Remote control only is provided. Radio control box is located in pilot's cockpit. Radio set may be pre-tuned to any four channels lying within the frequency range. Communication during the flight may take place on any one of pre-set channels. The frequency setting of transmitter may differ from the frequency setting of receiver. Radio set is ready to start operation 1-1,5 minutes after being switched on. For chennel change about three seconds are required.

Change from receive to transmit operation is controlled by the press-to-transmit button on the control column or on the navigator's desk. About half a second is required for changing the operation from receive to transmit.

Two-way radiotelephone communication using this set is accomplished by the pilot. The pilot selects also on the radio control box the desired channel. The navigator is also able to communicate using this set. For switching the radio set to transmit, on the navigator's desk a button "TRANSMIT" is located. The navigator may not select other channels. The gunner is able only to listen to the communication.

The radio set obtains its primary source from aircraft e-

lectric d-c system through the circuit breaker AZS-5 and from AC-main through the fuse PV-2 located on the AC-panel.

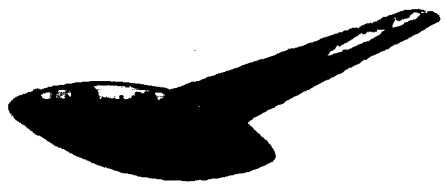
The tumbler switch for turning on the radio set is located on the left hand pilot's panel.

Antenna ASS-1.

Antenna ASS-1 /Fig. 8/ is a partly screened dipole antenna made of rust free steel. Antenna is designed for frequency range 100-150 MC. It has an aerodynamical cross-section. Overall length of antenna equals to 665 mm, length of unscreened part is 370 mm and of screened part 275 mm. Screened part of antenna /1/ is connected to the unscreened part /2/ by means of textolite insert /3/. In the upper /unscreened/ part and in the textolite insert a copper silver plated plate /4/ is secured. In the textolite insert is a hole 3,2 mm diameter, where copper lace /5/ connecting the plate /4/ to a silver plated brass tube /6/ is inserted. The tube is connected to the high-frequency socket 7 mounted in the antenna base for connection of feeder type LVK-1 /wave impedance 50 ohm/.

Feeder type LKV-1 is installed without any interruption by connectors. It is lead into the hermetical cockpit through an opening hermetically sealed by rubber caulk insertions, tightened with two flanges secured by six screws. Hermetically sealed opening is located on the hermetical cover rear the right side beside the 11th fuselage frame /Fig.19/. The form and length of different antenna parts is designed so, that the frequency characteristic of antenna input impedance meets all matching requirements in the whole operation frequency range.

Antenna is located to the right lower side of fuselage between frames number 10 and 11 by means of metal flange with



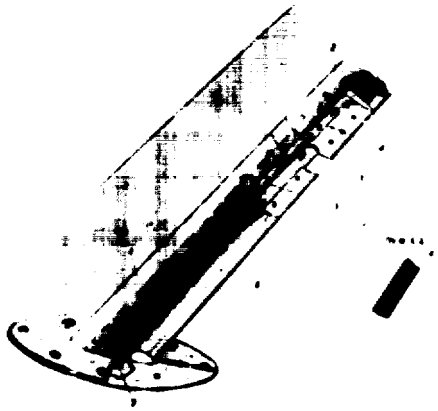


Fig. No 18: General view showing the design of the antenna AWC-1 /AGHS-1/.

1/- shielded part of antenna, 2/- unshielded part of antenna, 3/- insulating piece, 4/- plate, 5/- cord, 6/- tube, 7/- H.f. connector - 1/ Section A-A

eight pins. Angle between antenna axis and vertical axis equals to 30 dgr. This antenna location guaranteed suitable antenna radiation pattern. The antenna is grounded by the contact between antenna base and fuselage surface. Contact resistance should not exceed 100 microohms.

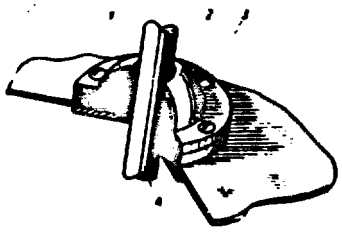


Fig. No 19: Hermetic lead-through piece.
1/- rubber packing, 2/- cup, 3/- screw, 4/- H.f. feeder.

Outline Characteristics of Antenna ASS-1.

1. Antenna efficiency range from 100 to 150 MC

2. Antenna radiator in aerodynamical form

overall length ..... 665 mm

length of screened part ..... 275 mm

length of unscreened part .... 370 mm

dielectric inset between the parts ..... 20 mm

3. Antenna resists without permanent set front load being equal to 100 kg and side load being equal to 35 kg.

4. Dielectric inset maintains distance between metallic parts to 20 mm.

In the antenna base high frequency socket for feeder connection is located.

6. The antenna is designed to operate in the temperature range from 60 centigrades to + 50 centigrades up to the altitude of 12000 metres.

7. The antenna is designed to resist vibrations between 20 and 80 cps having acceleration peak value of 40 m $sec^{-2}$.

RADIO - COMPASS ARK-5.

Radio-compass ARK-5 is used in the aircraft for

- approaching to the home and broadcasting stations
- DR-position determination.

Radio-compass ARK-5 will provide solution of the following navigation problems:

1/ approaching to a station using visual bearing indication
2/ approaching to a station using aural bearing indication
3/ leaving a station /auxiliary aid/
4/ drift determination and determination of direction and velocity of wind
5/ bearing determination by visual and aural method
6/ approaching to radio-ranges on the beam or using bearing.

Radio-compass ARK-5 is designed for three operation functions:

a/ aural reception of modulated and unmodulated signals using nondirectional antenna
b/ visual bearing indication
c/ aural reception of modulated and unmodulated signals using directional antenna.

Radio-compass ARK-5 consists of following component units:

1/ receiver with shock absorbing unit
2/ suppressed loop antenna RMD
3/ navigator's remote control box
4/ pilot's remote control box
5/ navigator's bearing indicator SVS
6/ pilot's bearing indicator SVP
7/ junction box
8/ hermetically sealed T-gear
9/ flexible shaft connecting the receiver and T-gear

10/ flexible shaft connecting the T-gear and pilot's remote control box

12/ lead-in insulator

13/ high frequency cabel of loop antenna

14/ band

15/ dehydrater unit

15/ fixed antenna.

Outline Characteristics of ARK-5.

Frequency range - continues from 150 to 1300 kc /3000-230m/.

Frequency dial accuracy - ± 3%.

Receiver sensitivity when internal noise output 2 volts for 15 volts output voltage:

on the 1st band better than 12 microvolts, on the 2nd and 3rd band better than 10 microvolts. Sensitivity for automatic direction finding better than 50 microvolts per meter for approach and better than 180 microvolts per meter for bearing. During the employment sensitivity decrease is permitted up to 20 microvolts for reception and up to 100 microvolts per meter for bearing.

Operation range of automatic radio-compass - 160 - 200 km

Power requirements: input voltage 27,5 volts direct current and 115 volts alternating current 400 cps. Direct current drain /at 27,5 volts/ 0,3 - 0,7 amp. normal and 8-10 amp peak. Alternating current drain at 115 volts not exceeding 1,4 amp. Receiver is a superheterodyne with the automatic loop antenna control on the output. The whole frequency range of receiver is divided into three bands.

1. 150 - 310 kc
2. 310 - 640 kc
3. 640 - 1300 kc

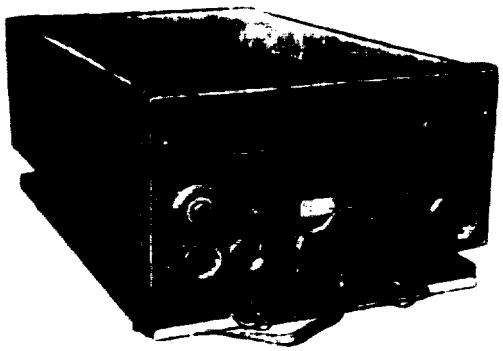


Fig. No 20: Receiver of the radio-compass ARK-5.

On the front panel of receiver following details are located:

1. Bracket for flexible tuning shaft connection
2. Socket with inscription "LOOP" for loop antenna radio-frequency cable plug connection
3. Socket A-4 for loop antenna control cable connection
4. Ground terminal /for connecting the receiver to the aircraft structure
5. Head "CLOSING" of screw fastening the receiver chassis in the case
6. Shield terminal /on the aircraft installation connected to the ground terminal/
7. Antenna terminal
8. Adjusting screw for sensitivity adjustment of automatic loop antenna control
9. Adjusting screw "REC GAIN" for receiver threshold sensitivity control.

At the right side of front panel is located socket for junction box cable connection.

The receiver contains a kenotron rectifier for supplying the plates and screen grids of tubes and also for supplying bias for control grids of tubes 6P3.

The receiver is equipped with 15 tubes.

Receiver tubes:

| type | 5C4 | 6F6 | 6K7 | 6B8 | 6N7 | 6P3 |
|---|---|---|---|---|---|---|
| quantity | 1 | 1 | 6 | 2 | 2 | 3 |

Suppressed Loop Antenna.

Suppresses loop antenna unit /Fig. 21/ consists of loop antenna, loop motor and deviation compensator.

Suppressed loop RMD is a directional antenna allowing determination of bearing of desired stations.

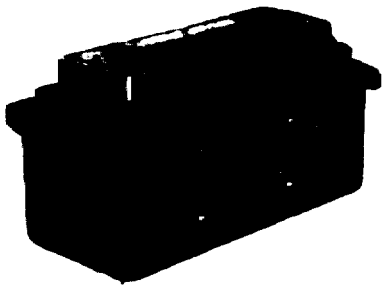


Fig. No 21: Suppressed loop antenna.

Suppressed loop RMD gives the same electrical results as the external loop does. On the contrary the suppressed loop antenna decreases the aerodynamical drag and protects against mechanical damage of antenna element because the antenna does not rise from

fuselage surface.

The loop is shielded and it is protected by chlorvinil cover against climatic phenomenon. The moving mechanism consisting of alternating current motor ARK /moving the loop antenna/, deviation compensator and seleyn system transmitting the loop antenna position to the indicators of pilot and navigator, is mounted in the loop antenna base. Loop-motor is asynchronous a.c. two--phase squirrel-cage motor. Loop-motor is joined to the loop through a reductor gear decreasing the revolution speed.

Metallic part of aircraft and the antenna also pick up electromagnetic energy of transmitting station. One part of this energy is transformed into Joule-heat energy, the other part is reflected immediately. The electromagnetic energy of transmitting station. One part of this energy is transformed into Joule-heating energy, the other part is reflected immediately. The electromagnetic field near the aircraft is thus distorted and bearing errors are evocated. To obtain the tune relative bearing /KUR/ a correction,/deviation/ must be added to the value indicated on the bearing indicator.

The loop antenna on the aircraft is located symmetrically to other metallic structures. The bearing errors are, therefore, also symmetrical and they may be expressed by a deviation curve. The symmetrical law makes possible to compensate the errors automatically by an automatical deviation compensator. To remove the humidity dangerous for antenna mechanism a dehydrator is located aside the loop antenna. The dehydrator unit consists of a transparent tube with caps on both ends. To one cap a durite pipe connecting the dehydrator unit to the antenna body is fixed, the other cap has . The tube is filled with dehydrator

[illegible] /silicagel with cobaltchlorid/. The air flows through the dehydrator unit and only dry air reaches the loop antenna inner. The cobaltchlorid changes its colour when dehydrator capacity used up.

Dry dehydrates compound is dark-blue. If the dehydrator compound becomes moist, it changes the colour to pale-blue and finally to greayish rose.

Dehydrator unit is secured by two spring holders locked with wire.

Remote Control Box.

On the front panel of remote control box /Fig.3/ following controls are located:

1/ "A1-A5" switch for reception of modulated and unmodulated signals

Fig. No 22: Remote control box.

2/ Function selector switch

a/ off - radio compass turned off

b/ comp - automatic loop antenna control is turned on, both loop antenna and nondirectional antenna are connected to the receiver.

c/ ant - automatic loop antenna control is turned off, nondirectional antenna only is connected to the receiver.

d/ loop - loop antennais connected to the receiver only manual loop antenna control is turned on.

3/ Receiver tuning control knob with inscription "TUNING" moves not only the frequency dial but its movement is transmitted by the flexible shaft also to the variable tuning capacitor of receiver.

The proper setting to transmitting frequency is indicated by maximal declination of tuning indicator pointer to the right.

4/ Band selector switch selects frequency band in receiver. Band selector dial indicates the band selected.

5/ Volume control knob.

6/ Dial light control knob controls illumination of frequency dial and tuning indicator /two spare bulbs are located in the box/.

7/ "CONTROL" button switches the control from one box to the other.

8/ Green signal lamp lights if the radio-compass is turned on. The remote control box contains also fuse for direct-current circuit /5 amps/ and a fuse for alternating current circuit /2 amps/.

Navigator's bearing indicator.

Navigator's bearing indicator makes possible to determine the loop antenna position /relative bearing KUR/, tune bearing /UHP/ and azimuth /reverse bearing - ORP/. The indicator scale is divided to 360 dgr, each mark bearing one degree. The dial may be returned by the knob "HEADING" located on the indicator. The pointer is moved by a selsyn-repeater according to movement

[illegible] selsyn-transmitter connected to the loop.

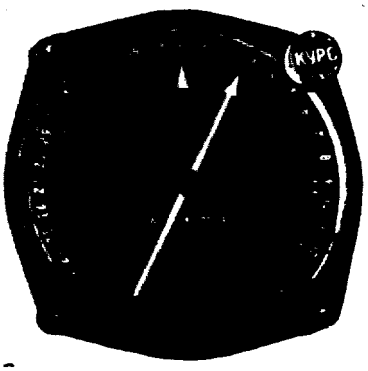


Fig. No 23: Navigator's bearing indicator.

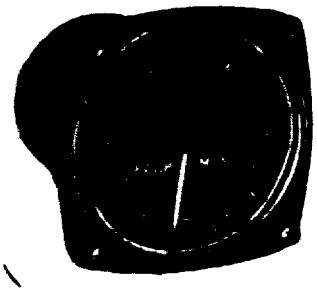


Fig. No 24: Pilot's bearing indicator.

Pilot's bearing indicator.

Pilot's bearing indicator /Fig.24/ indicates the relative bearing, the angle between longitudinal axis of aircraft and the direction to the radio station /bearing error compensated/. Indicator scale is divided to 360 degr., each mark being 10°. The pointer is moved by a selsyne /like the navigator's indicator/.

Junction Box of ARK-5 and Control Relay.

In the junction box are 48 terminal screws in four rows to which all elements of radio-compass are connected /except both loop antenna cabels: high frequency cable and control cable/. Terminal screws are marked with numbers on the beginning and on the end of each row only. Number of any terminal in the centre must be determined by counting.

In the junction box is located also the control relay switching the control from the one remote control box to the other.

Fixed non-directional Antenna ARK-5

Fixed non-directional antenna of radio-compass ARK-5 is located above the fuselage and it is an extension of liaison set antenna separated by insulator type 6064c. The one end of antenna device is fixed to the fin, the other to the antenna mast fixed to the pilot's cockpit cover frame. The antenna lead-in uses insulator K 94.

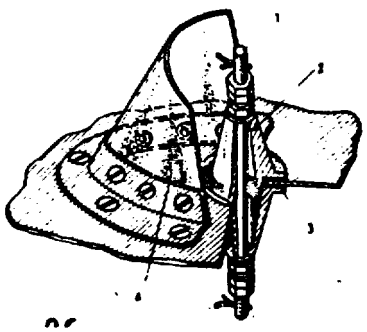


Fig. No 25: Lead-through insulator.
1/- rod, 2/- insulator, 3/- packing, 4/- antifreeze screen.

The insulator K-94 is protected against icing by a special fibre-glass cover /Fig.26/. For antenna lead-in wire PVLE secured to support insulators is used.

Power Input of Radio-Compass ARK-5.

The radio-compass is supplied by the alternating current mains through the fuse PV-2 in the a-c-box and also by the direct current through the breaker AZS-10.

Location of Radio - Compass.

Location of radio-compass units in the aircraft is shown in Fig. 26. Interconnetting diagram is on Fig. 26. Receiver, loop antenna and dehydrator unit are located under the rear part of pilot's cockpit cover beyond armour-plate. The fixation of units and cable plugs may be checked through an opening on the right side of fixed part of pilot's cockpit cover.

When removing the receiver, proceed as follows: loosen the capti screwn of cover; remove the cover; disconnect cable plugs, flexible shaft, antenna lead-in and grounding strap, two holder knob pull the receiver a little up and remove it from aircraft. When removing the loop antenna, proceed as follows: remove the cover,disconnect the cable plugs, disconnect the durite pipe, loosen the screws fastening the antenna to its support and remove the antenna upwards. Before removing the loop note the exact position of loop axis in regard to the support to avoid installation error after re-installing the loop.

Dehydrator unit is secured by two spring holders. The upper ends of holders are locked with wire. When removing the dehydrator unit, remove the cover, disconnect the durite pipe from dehydrator, remove the locks and remove the dehydrator unit from holder.

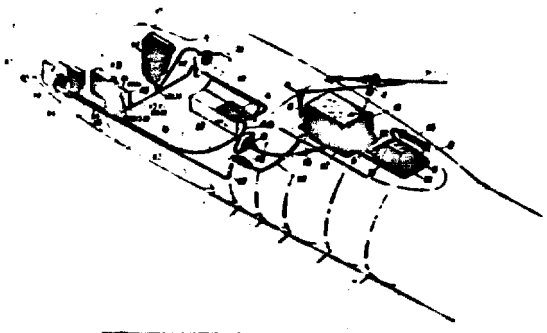


Fig. No 26: Mounting diagram of radio compass ARK-5.

1/- navigator's control desk, 2/- navigator's bearing angle indicator, 3/- pilot's bearing angle indicator, 4/- pilot's control panel, 5/- distributing box, 6/- H.f. cable of frame, 7/- antenna, 8/- antenna in-lead, 9/- frame inside of fuselage, 10/- receiver ARK-5, 11/- lead-through insulator, 12/- antenna down-lead, 13/- T-piece of flexible shaft, 14/- frame draining element, 15/- angle adaptor, 16/- flexible shaft, 17/- A.c. panel, 40/- navigator's electro-panel, 60/- pilot's right panel, 70/- pilot's instrument panel, 90/- navigator's instrument panel, KI/- hermetized connector SHRG-23, KII/- plug connector, KIII/- plug connector, KIV/- plug connector, K1/- cable from receiver to frame, K2/- cable from receiver to hermetized connector KI, K3/- cable from hermetized connector KI to distributing box, K4/- cable from navigator's control panel to distributing box, K5/- cable from distributing box to pilot's control panel, K6/- cable from distributing box to navigator's bearing angle indicator, K7/- cable from distributing box to pilot's bearing angle indicator, 30/- cable from electro-panel to navigator to distributing box.

Navigator's bearing indicator is located on the navigator's instrument panel and it is secured by three screws.

Pilot's bearing indicator is located on the pilot's instrument panel and it is secured by four screws.

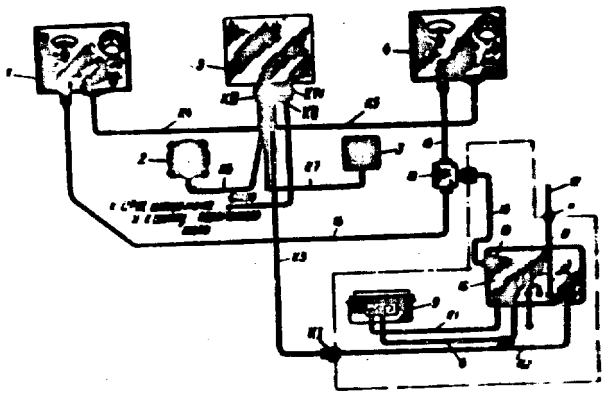


Fig. No 27: Semi-mounting diagram of radio-compass ARK-5
/For specifications see Fig.26/.

Navigator's remote control box is located on the left besides the navigator's instrument panel. For removing it, loosen three screws fasting the front panel of control box to its frame, disconnect the flexible shaft, remove the telephone cord plug and pull the control box out. It leaves easy the frame fixed to the aircraft structure. When removing the frame of control box, disconnect the conductors from the terminal panel and loosen four screws that fasten the frame.

Pilot's remote control box is located on the upper panel of pilot's right hand desk. Before removing the control box, remove the side panel of the desk. Further is the removal proceeding like to that one of navigator's remote control box.

After the remote control boxes have been re-installed into the aircraft, check accord of frequency dial indication and the actual frequency setting of receiver.

Junction box of radio-compass is located on the top of the left of rear part of navigator's compartement. When removing

the junction box, loosed the locking rings of cable plugs and remove their pins. Loosen the upper and lower screw on the right beside the junction box and loosen also the centre screw on the right. Remove the junction box with mounting frame.

To reach the conductor terminals in the control box, loose two plastic nuts and remove the cover.

The T-gear of flexible shaft and hermetical connector K-1 of radio-compass both are located on the left side of rear partition of pilot's cockpit.

The T-gear and connector are accessible for checks from the pilot's cockpit and also through an opening on the left side of fuselage.

## 4. RADIO - ALTIMETER FOR LOW ALTITUDES RV-2.

Radio altimeter type RV-2 /Fig.28/ measures actual flight altitude above the ground below.

Radio altimeter indications are not effected by barometric pressure temperature, atmospheric conditions, terrain covering /earth, water, snow, ice/ and air-speed.

The radio altimeter is considered as a means for instrument flying descending through cloud-base and instrument landing. Radio altimeter RV-2 provides measurement of altitudes in the range from 0 to 1200 metres.

The radio-altimeter set RV-2 consists of following component units:

a/ transmitter-receiver /transceiver unit/

b/ dynamotor RV-11 AM

c/ indicator

d/ transmitting and receiving antennas.

Transmitter-receiver /Fig.29/ is connected by the transmitting and receiving antennas by means of high-frequency feeders. The signal of transmitting antenna is emitted down from

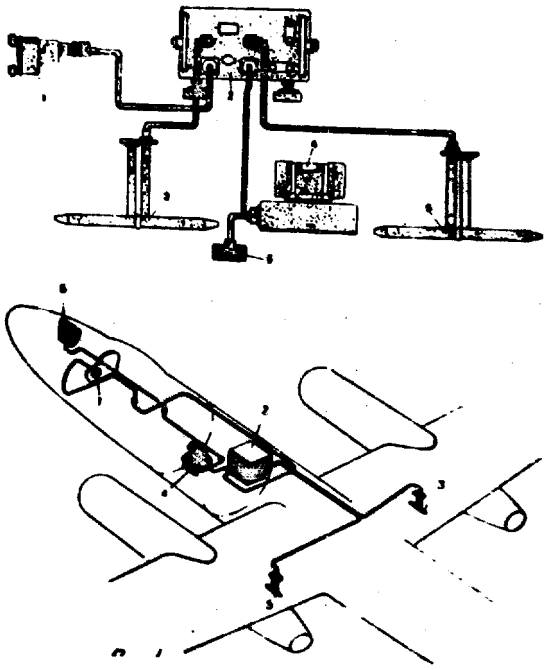
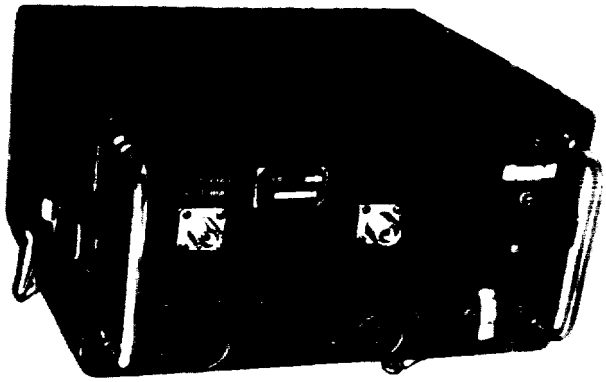


Fig. No 28: Diagram showing connection and location of blocks of RV-2-
1/- altitude indicator, 2/- transceiver, 3/- receiving antenna, 4/- converter, 5/- transmitting antenna, 6/- CRSHCH

the aircraft to the ground. This signal is reflected by the ground and it returns to the aircraft, where it is received by the receiving antenna, connected to the input of radio-altimeter receiver. At the same time to the input of receiver is fed also a direct /undelayed/ signal by a special feeder installed in the



[illegible] Transceiver RV-2

[illegible] of the transceiver between its receiving [illegible] transmitter. The transmitted frequency varies periodically with [illegible] 124 cps/ in frequency limits 424-464 MC when [illegible] switched to "0-120 m" range and it varies in frequency [illegible] when altimeter operation switched to high [illegible] limits 1200-1200 m/ range.

The way-length of reflected signal depends on the flight altitude and it is always greater than that of direct signal. The reflected signal reaches also the receiver input with [illegible] and because the signals are frequency modulated the frequency of reflected signal differs from the frequency of direct signal, difference being function of the flight-altitude above [illegible] below. The best frequency originating on the receiver input by the interference of direct and reflected signal corresponds to the difference mentioned above. Both signals are [illegible] frequency amplified and fed to the frequency-meter [illegible] to direct current which valve is direct [illegible] best frequency. Direct current flows through [illegible]

indicator /d-c instrument/ and deviates into points. Direct current valve is proportioned to the beat frequency /difference between the direct reflected signal/ and, therefore it is also proportional to the flight altitude above the ground. The indicator scale is graduated in metres of altitude above the ground.

The transceiver RV-2 is put into metal case secured to its block mounting by two fasteners. On the front panel of transceiver there are situated following details: high frequency cables receptacle of transmitting and receiving antenna cables, sockets of indicator and dynamotor cables, holes for "Zero adjustment" of high and low altitudes, holes for "calibration" of high and low altitude and fuse.

Technical Characteristics of RV-2

| | | |
|---|---|---|
| 1. Measurement range /over-all/ | 0 | - 1200 m |
| low altitude range | 0 | - 120 m |
| high altitude range | 100 | - 1.200 m |
| 2. Altitude indication accuracy on the low altitude range | ± 2 m or ± 5% of indicated value whichever is greater | |
| on the high altitude range | ± 20m or ± 5% of indicated value whichever is greater | |
| 3- Power requirements | 65 watts of 27 volts | |
| 4. Total wight less cables | 14 kg | |

D y n a m o t o r RV-11 AM

Dynamotor supplying the radio altimeter for low altitudes is located on the right of bombs-compartment between the fuselage frames number 18b and 19. Two rubber rope amortisators fasten the transceiver to the mounting frame.

The power for dynamotor is obtained from aircraft electrical

system through the circuit breaker located on the navigator's switch panel.

Receiving and transmitting antenna.

The receiving and transmitting antennas /Fig. 30/ of radio-altimeter electrically and constructively are alike. The antenna is a half-wave dipol designed analogically to the antenna of radio-altimeter RV-10. The receiving antenna is located on the star-board wing behind the rear longerone between the 3rd and 4th rib. The transmitting antenna is located symmetrically on the same wing.

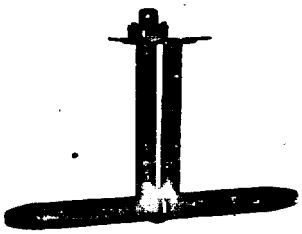


Fig. No 30: Antenna of RV-2-.

Altitude indicator.

Radio-altitude indicator /Fig.31/ is a direct current instrument. When radio-altimeter turned off, indicator pointer is on the left stop. Zero-position of indicator corresponds to 1,5 milliamts. Full-scale position corresponds to 6,5 ma.

In the indicator unit also two switches are located. The first switches on the primary power of dynamotor, the other controls the ranges selector delay. When turning the knob of the later switch, the numbers on the indicator dial are also changed.

Turning the knob clockwise results in selection of high altitude range. Turning the knob counter clockwise results in selec-

... low altitude range /0-160 m/.

Fig. No 31: Indicator RV-2

5. RADIO-ALTIMETER FOR HIGH ALTITUDES TYPE RV-10.

Radio-altimeter type RV-10 /Fig.32/ is designed for measuring of flight altitude above the ground in the altitude range from 80 to 15 000 metres. A pulse-methode measurement is used. The transmitting antenna connected to the transmitter emits short pulses in the very high frequency range. The impulses penetrate easy fog and clouds, they strike the ground and are reflected back to the aircraft where they are received by an antenna connected to the receiver and fed to the indicator.

In addition to the reflected signal, a direct pulse originating from transmitter reaches also the receiver input. Indicator measures the time delay between the receptions of both pulses. The speed of electromagnetic waves is constant. The time delay is thus proportional to the flight-altitude above the ground. The time delay is measured on the indicator scale from the leading edge of direct pulse to the leading edge of reflected pulse the scale is graduated in metres.

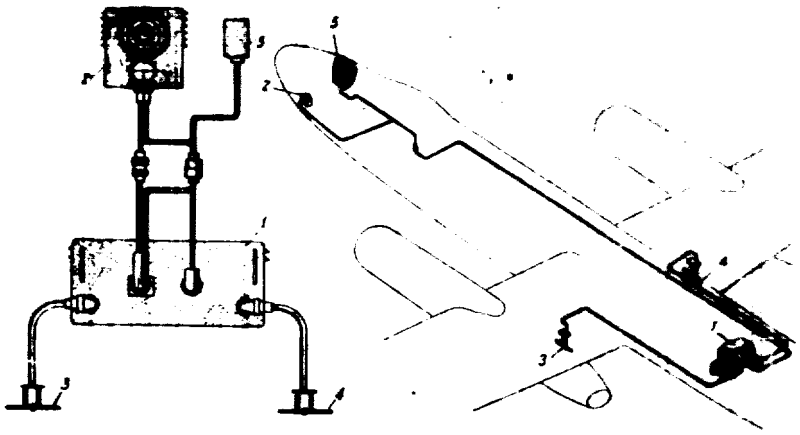


Fig. No 32: Diagram showing connection and location of blocks of RV-10

1/- transceiver, 2/- indicator, 3/- transmitting antenna, 4/- receiving antenna, 5/- A.c. panel

The radio-altimeter consists of following component units

1/ transmitter-receiver /transceiver unit/

2/ indicator

3/ receiving antenna

4/ transmitting antenna

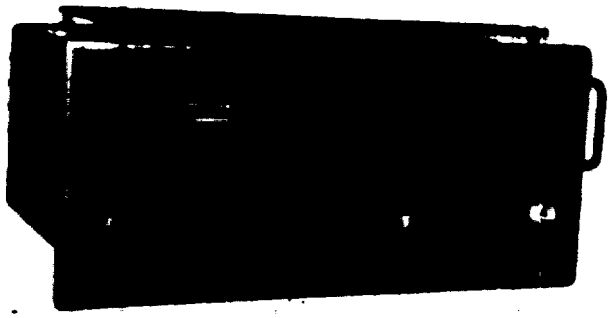


Fig. No 33: Transceiver of RV-10.

Technical data of RV-10

| | |
|---|---|
| 1/ altitude measurement range | 80-15 000 metres |
| 2/ altitude measurement accuracy | |
| a/ for scale multiplier "1" | 15 m or ± 0,25% of indicated altitude |
| b/ for scale multiplier "10" | 150 m |
| 3/ Operation mode - pulse modulated pulse frequency | 99921 ± 25 cps for scale multiplier "1" |
| 4/ Carrier frequency of transmitter | 9992 ± 10 cps for scale multiplier "10" |
| 5/ Pulse length | 0,5 microsec. |
| 6/ Dial accuracy | |
| a/ for scale multiplier "1" | 10 m |
| b/ for scale multiplier "10" | 100 m |
| 7/ Impulse power output | |
| a/ for scale multiplier "1" | 7 watts |
| b/ for scale multiplier "10" | 5 watts |
| 8/ Power consumption | 150 watts at 115 volts ± 3%, 400 cps |
| 9/ Receiver sensitivity | 60 microvolts |
| 10/ Receiver band width | 6 MC |
| 11/ Over-all sensitivity of radio-altimeter measured using test set T-1 | |
| a/ for scale multiplier "1" | over 66 scale units |
| b/ for scale multiplier "10" | over 60 scale units |
| 12/ Possible pulse shift on the indicator dial | |
| a/ for scale multiplier "1" | over ± 45 m |
| b/ for scale multiplier "10" | over ± 450 m |
| 13/ Pulse width measured on the indicator scale when the pulseheight equals 6 mm. | less than 83 m |

14/ Indicator pattern differs from circle not over 1 mm on diameter.

15/ Indicator pattern changes form when turning the controls "centering vertical" and "centering horizontal" change exceeds 6 mm.

16/ When switching over the scale multiplier, the indicator pattern form change should not be over 3,5 mm.

17/ The life of apparatus is 200 flight hours during the period of 14 months beginning with the date of mounting the apparatus into the aircraft, besides 1 year of storage.

Interconnecting diagram shows the figure.

T r a n s c e i v e r

The transceiver unit RV-10 is put in a metal case located on the front part of aft /rear fuselage/ compartments. Two shock mounts 2/1349 fasten it to the shock mounting frame. The transceiver consists of two sections: the receiver and the transmitter.

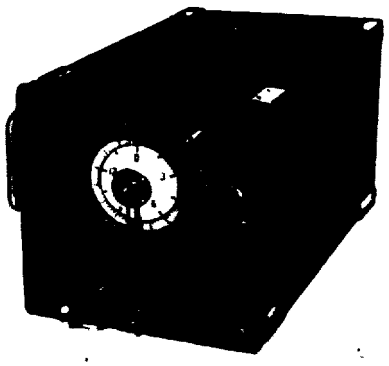


Fig. No 34:

The power supply unit is situated inside the transceiver unit. The cathode ray tube power supply is positioned inside the indicator box. In the left lower edge of transceiver front panel is

located the coaxial-cable socket for transmitting antenna cable connection. On the right side the receiving antenna cable socket is symmetrically located. In the centre the power cable socket and indicator cable socket are located.

Altimeter Indicator

The indicator /Fig.34/ in its pedal case is located on the left side of navigator's compartment between the 4th and 5th fuselage frame. The shock mounts type 27L49 fasten it to the mounting frame. On the front panel of indicator following details are located: Oscillograph tube screen with rubber hood protecting against undesired day-light; transceiver cable sockct; turn-off-switch; two control knobs /"RECEIVER GAIN" at the left, "PATTERN DIAMETER" at the right/. Scale multiplier selector switch and holes for the adjustment /"x10" and "x1"/.

INSTRUMENT LANDING EQUIPMENT.

Instrument landing equipment is used for air-traffic control in the aerodrome zone during of an aircraft-group. It is also used as an aid for approach and landing.

To accomplish the requirements following sets in the aircraft are located: localizer receiving equipment, glide-path receiving equipment, marks beacon receiving equipment and radio-distance equipment. They require special radio-beacons and communications sets to be installed on the ground.

1. Localizer receiver KRP-F
2. Glide-path receiver GRP-2
3. Junction box
4. Remote control box M-50
5. Indicator PSP-48
6. Glide-path antenna
7. Localizer antenna
8. Matching unit

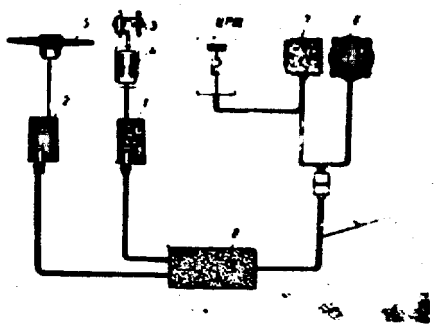


Fig. No 35: Diagram showing connection of blocks KRP-F and GRP-2.

1/- receiver KRP-F, 2/- receiver GRP-2, 3/- localizer antenna, 4/- matching unit, 5/- glide path antenna, 6/- indicator PSP-48, 7/- control desk, 8/- distributing box.

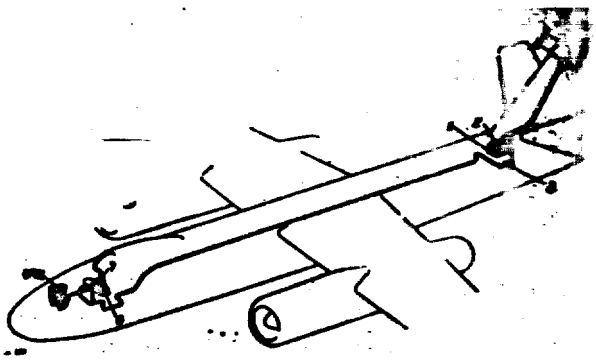


Fig. 1

Interconnecting diagram is shown on Fig.36. Receivers KRP-F and GRP-2 are located in the upper part of the aft compartment and they are fixed to shock mounting frame. Junction box is located in the upper front part of aft compartment. Six screws fasten it to its support. In the junction box there are installed fuse brackets for primary source /27 volts/ of both receiver KRP-F and GRP-2. Receiver MRP-48P is located on the left side in the front part of bomb compartment. Four holders fasten it to the shock mounting.

Remote control box M-50 is secured to the right hand panel in the pilot's cockpit.

Antenna of the receiver MRP-48P is located on the botten of fuselage in front of bomb jetisson apperture between the 17th and 18th fuselage frame.

Before removing the antenna, remove the covers of front part of bomb compartment, disconnect the high frequency cable from antenna, loosen the screws and remove the cover of antenna opening. Holding by the one hand the nuts loosen by the other hand the 24 screws securing the antenna.

Receiving antenna of GRP-2 consists of two horizontal dipols located on the top of fin. They are installed in a special fibre-glass cover.

Slot antenna of receiver KRP-F is located in the upper part of fin. The feeder terminals are installed in a special cavity closed by duraluminium covers with slots for radiation of electromagnetic energy. Both slots are fible-glass covered. The antenna covers are fixed by screws to the rivet-nuts on the fine surface. Below the cavity-antenna is located the matching unit. It is secured with its bracket to the fin surface. The matching unit is accessible through a special opening.

The high-frequency antenna cables of radio-receiver KRP-F and GRP-2 are sticked through a special tube in the fine.

Signalling unit of MRP-48 is located in the front part of pilot'scockpit. Instrument landing indicator PSP-48 and signalling lamp of MRP-48p are located on the pilot's instrument panel.

Localizer receiving equipment KRP-F

Localizer receiving equipment KRP-F belongs to the instrument landing equipment. It is designed for reception of signals of the

localizer beacon laying out the approach axis /prolongated axis of runway/. Localizer receiving equipment KRP-F is a very high frequency superheterodyne with six crystal controlled receiving frequencies: 108,3; 108,7; 109,1; 109,5; 109,9; 110,3 M .

The receiving antenna receives the complicated spectrum of signal transmitted by the phase-beacon. The radiation of beacon consists of

1/ directional radiation,

2/ nondirectional radiation with circular radiation pattern.

The directional radiation produces around the beacon horizontal plane two lobes. Boundary of the lobes determines the approach axis. The directional radiation is a very high frequency signal amplitude modulated with 60 cycles. The phase modulation in the one lobe is quite opposite to that in the other.

The nondirectional radiation is a very high frequency signal of the same frequency as the directional signal. It is amplitude modulated with 10 000 cps. In addition there is the carrier frequency and also frequency modulated with 60 cps, modulation shift being $\pm$ 1 kc.

Sub-carrier frequency 10 000 cps and frequency modulation are used for making possible to distinguish in the receiver both 60 cps modulations, one of the directional radiation the other from the nondirectional radiation. The phase of 60 cps frequency modulation of the sub-carrier is the same in all points around the beacon. It is in phase with the modulation of directional radiation in the lobe and it is 180 degr. out of phase with that in the other lobe. The phase of 60 cycle modulation of the nondirectional radiation is the same without regard to aircraft position, this radiation is called "constant phase transmission".

- -

[redacted] directional radiation changes [redacted] courses from zone corresponding to on[redacted] [redacted] other one. This radiation is call[redacted] "[redacted] transmission".

[redacted] PSP-48 is used as an indicator instrument [redacted] receiver [redacted]. The vertical pointer of the indicator indicates [redacted] position of the aircraft to the right or left of the approach axis /course/.

If the aircraft is "on course", the localizer antenna receives the constant phase only and the indicator pointer maintains its centre /zero/ position. If the aircraft is not on course, the

Fig. No 37: Receiver KRP-F.

localizer antenna receives also the variable phase transmission. According to the deviation of aircraft position to the one or the other side from approach axis, the 60 cycles modulations of both transmissions are in phase or out of phase.

The both ph ses are compared in a special stage and the indicator pointer deviates to the corresponding side. The pointer suggests where should be the aircraft steered to reach the approach axis. The receiving equipment contains also an alarm device. Leck of a signal reception and any fault of receiver are signalled by a white alarm flag appearing in the window on indicator dial, which indicates disablement of instrument landing equipment.

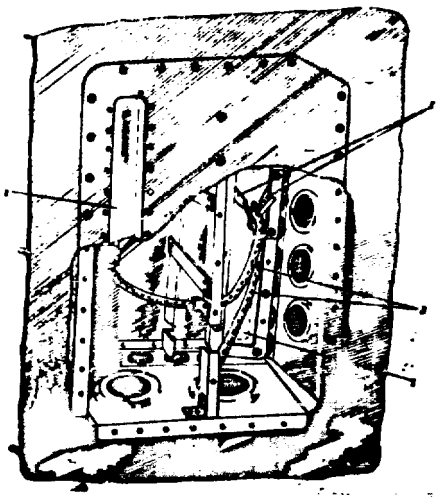


Fig. No 38: Localizer receiver slot antenna.
1/- plexiglass plate, 2/- terminals for soldering the feeders, 3/- H.f. feeder.

During the normal operation condition the window is on the indicator dial covered by a black flag.

Change of frequency channel is controlled by the remote control box. This box switches on also the receiver GRP-2 and controls its frequency. Receiver operates on 27 volts d.c. All units of instrument banding equipment are interconnected by cables

and junction box according to cabling diagram. Receiver KRP-F uses a slot antenna located in the aircraft fin.

Slat antenna of localizer receiver and matching unit

The antenna is designed as a box with dimensions 450x290mm. It is installed in the fin /Fig.38/.

In the box are two slots 39x398 mm with dielectric inserts /1/. A soldering terminal /2/ for feeder connection to each slot side is occured. The matching unit /Fig.39/ is used for proper tuning of slot antenna. Matching unit consists of textolite base and two holders fastening two copper silver-plated tubes /1/. The tubes are connected together by a slide-yoke /2/. Change of its position results in change of tuning and matching.

For interconnection of slots, matching unit and receiver, conductor type RDB-82 is used.

Slot antenna with the matching unit are adjusted so, that on the mean frequency of 190,1 MC standing wave ratio below 1,6 is obtained.

Receiver KRP-F is located between the 36th and 37th fuselage frame.

Glide-path receiving equipment GRP-2.

Glide-path receiving equipment GRP-2 /Fig.40/ is a very high frequency superheterodyne receiver operating on three fixed channels 332,6; 333,8 and 335 MC. Channels are changed without readjustment of receiver by selecting one of three crystals controlling the frequency of master oscillator. Crystal selection is remote controlled by the remote control box and control relays. Both receivers GRP-2 and KRP-F use the same remote control box.

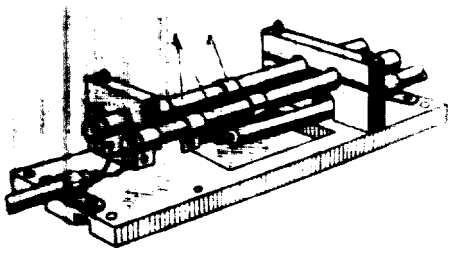


Fig. No 39: Matching unit.
1/- copper tube, 2/- connecting bridge.

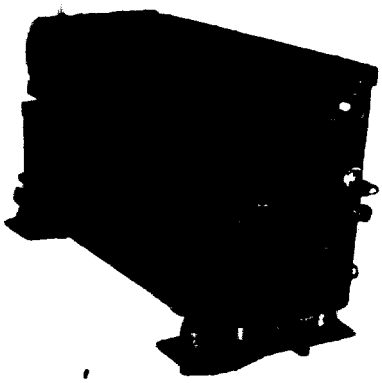


Fig. No 40: Receiver GRP-2.

The transmission of glide-path transmitter produces in the vertical plane two lobes. Radiator pattern of glide-path transmitter antennas are chosen upt, that the equisignal zone in the lobe intersection lays out the glide-path. When the aircraft is on the glide-path, signals originating from both lobes are equal.

If the aircraft deviates from glide-path, the signal of the one lobe shall predominate on the receiver input.

The transmission of the upper lobe is distinguished from

that of the lower by modulation frequency, upper lobe modulation being 150 cycles and lower lobe modulation 90 cycles.

Above the equisignal zone, the signal with 150 cycles modulation predominates and below the equisignal zone also the signal with 90 cycles.

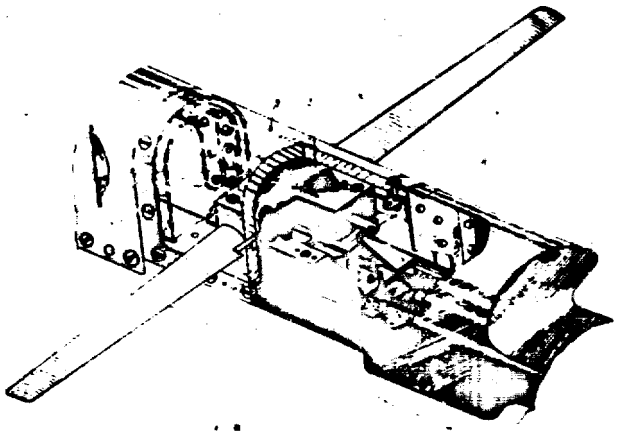


Fig. 1/- b
tact plate.

During the flight in the operation range of glide-path transmitter, the glide-path receiving equipment receives two signals of the same carrier frequency.

One signal is modulated with frequency 90 cycles, the other signal is modulated with frequency 150 cycles.

On the audiofrequency amplifier of receiver appear two signals, 90 cycles and 150 cycles. Depending upon the aircraft position with regard to the glide-path /equisignal zone/ both signals are equal or one signal predominates. The receiver output stage distributes both signals. Each signal is rectified separately. Currents corresponding to the two signals are compared in the indicator PSP-48. Opposite currents obtained from

[illegible]ed signals 90 and 150 cycles are fed to the horizontal pointer of indicator. If the aircraft flies in the equisignal zone, both signals are equal and the indicator pointer shall not deviate. If the signal 90 cycles predominates the 150 cycles signal, the indicator pointer shall deviate upwards. If the 150 cycles signal is predominating, the indicator pointer shall deviate downwards. In addition is the sum of both currents corresponding to the signals 90 and 150 cycles fed through the alarm flag coil which inclines the black part of flag to the window in indicator dial.

The receiver is supplied by the aircraft electrical system. It uses an antenna mounted on the fin. The glide-path receiver is fixed to the mounting frame screwed to a special support between the 36th and 37th fuselage frame.

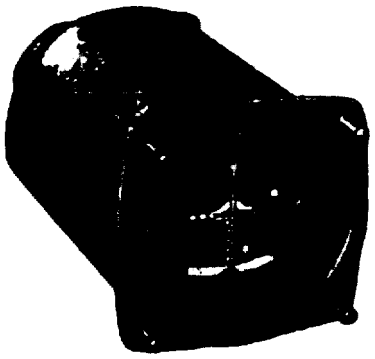


Fig. No 42: Indicator PSP-48.

Antenna of glide-path receiver.

The antennais constructed in form of two blades:

1. located on the top of fin. The antenna blades are secured by screws to the textolite base;

Fig. No 43: Control element.

2. which insulates both blades each other and insulates them also from the aircraft structure. The mounting is covered with fibre-glass cover.

Indicator PSP-48.

The course and glide indication is provided by the indicator PSP-48. Two moving coil instruments are installed in a common case of this indicator. The pointer of these instruments are perpendicular. The vertical pointer indicates the glide. Indicator is located on the pilot's instrument panel.

Remote control box.

The control box /Fig.43/ contains all controls for the operation of both receivers /localizer receiver and glide-path receiver/. This box contains a primary power source switch, a channel selector switch and an audio volume control for headset reception. Remote control box is located on the right hand pilot's panel.

Junction box.

Junction box is used for junction of interconnecting cables. The box is located on the 36th fuselage rib.

Power supplies.

Fillament of both receiver /localizer and glide-path/ are supplied by the aircraft electrical d.c. system. Each receiver employs one dynamotor U-18-1 for supplying the plate circuits. Primary power is obtained from electrical d.c. system. The current drain is 3 ampers for localizer and glide-path receiver. A circuit breaker AZS-15 located on the switch panel is used.

Marking beacon receiving equipment.

Marker beacon receiving equipment MRP-48P /Fig.44/ belongs to the instrument landing equipment. The marker beacon receiving equipment receives the marker beacon signals and indicates exactly the moment when the aircraft passes over the marker beacon.

The marker beacon receiving equipment MRP-48P /"mark 1"/ consists of following units:

1/ receiver MRP-48P
2/ suppressed antenna
3/ signalization unit
4/ indicator lamp

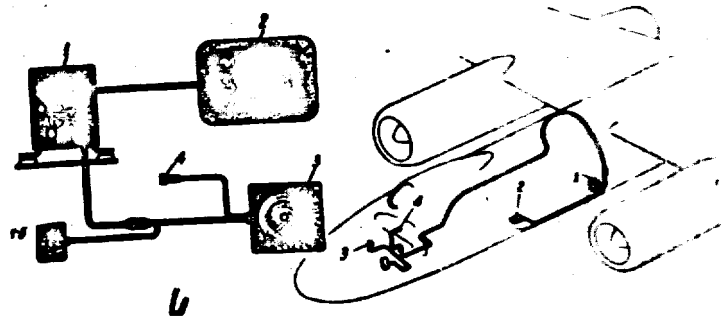


Fig. No
1/- rece
1/- Box

[illegible] receiver provides also reception of beacons [illegible] other frequencies within the range 65-80 MC.

[illegible]-receiver MRP-48P /Fig.45/ is a very high frequency re[illegible] of the direct tuned type adjusted for 75 MC operation. The operation frequency may be changed by changing the adjustment of receiver circuit within the frequency range 65-80 MC. The marker beacon signal is picked-up by the suppressed antenna /Fig.4/ amplified and detected. Modulation frequencies 0,4-3,0 kc are rectified in the receiver.

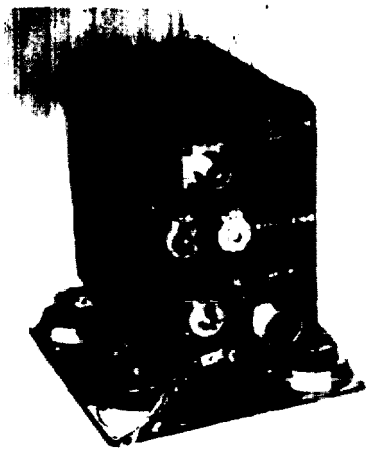


Fig. No 45: Receiver MRP-48P.

Produced d.c. pulses close the relay according the code of marker beacon and the indicator lamp on the pilot's instrument panel flashes accordingly.

The bell on the signalisation unit gives signals in the same time /Fig.47/. Fillament circuit operates on 28 volts d.c. Plate voltage is obtained from the junction box of radio-compass ARK-5.

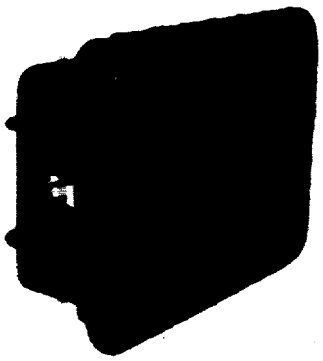


Fig. No 46: Antenna for mounting into the fuselage /MRP-48A/

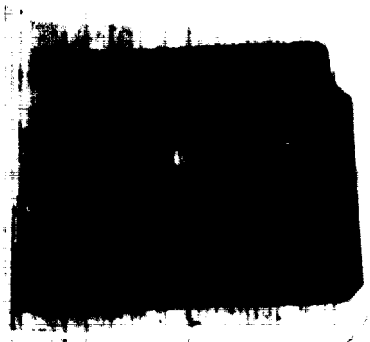


Fig. No 47: Signalling block.

Location of MRP-48P units on the aircraft.

Receiver MRP-48P is located on the left side of bomb compartment between the fuselage frames number 18b and 19. Its shock-mounting is secured to a special support.

Suppressed antenna is secured by screws to the inner surface of fuselage between the frames number 17a and 18c.

Signalization unit is secured by four screws to the frame [illegible] of the 17a fuselage frame.

Distance measuring equipment SD-1.

Distance measuring equipment type SD-1 /Fig.48/ is used for

1/ indication of distance from aerodrome equipped with responder type RD-1

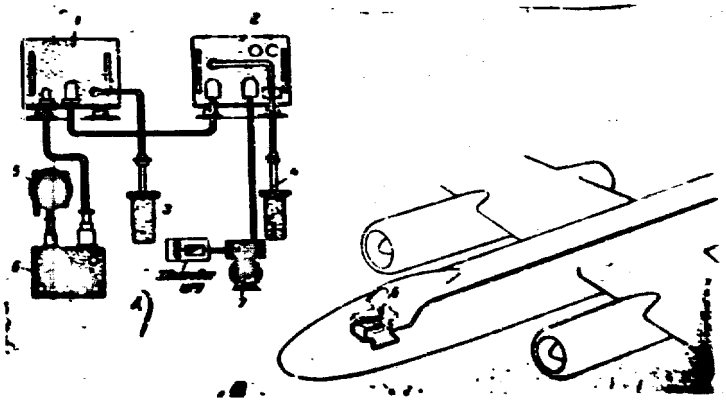


Fig. No 48: Diagram showing connection and location of blocks SD-1.

1/- receiver, 2/- transmitter, 3/- receiving antenna, 4/- transmitting antenna, 5/- indicator, 6/- control panel, 7/- rotary converter MA-250.

1 - Rear CRU

2/ circle-pattern flying around the destination aerodrome. The responder beacon is the centre of the circle-pattern;

3/ determination of distance between the aircraft and the touch-down-point during the approach.

The equipment consists of following units/

1/ DME receiver SD-1

2/ DME transmitter SD-1

3/ receiving antenna SD-1

4 transmitting antenna SD-1

5 distance indicator

6 remote control box of DME-type SD-1

7 inverter MA-250

Distance between the aircraft and aerodrome is determined by measuring the time interval between the transmission of a pulse and reption of corresponding echo from ground-responder. The DME-transmitter is connected by a high-frequency cable to the transmitting antenna. It transmitts twin-pulses with pulse-recurrence-frequency of 100 cycles, corresponding to an interval between pulses with duration of 10 000 microsec. Each twin-pulse consists of two separate pulses with a pulse length of 3 microsec. And time interval between pulses of 2 or 6 microsec corresponding to the 1st, 2nd and 3rd operation channel.

Transmitted twin-pulses /interrogation pulses/ are received by the receiver of the ground-responder-beacon. The decoding circuit in the receiver lets through only the twin-pulses of the

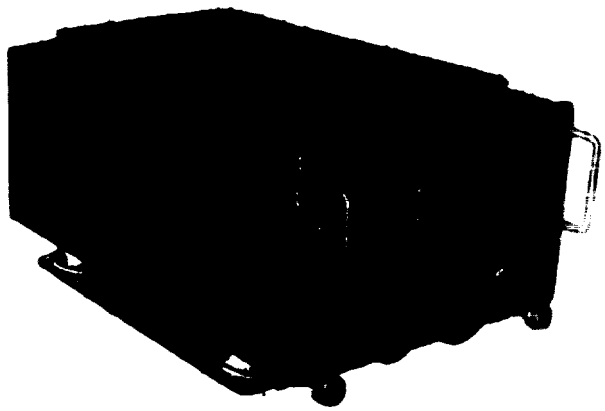


Fig. 4 DME Transmitter SD-1.

[illegible] circuit. After discrimination of pulses [illegible] the [illegible] circuit transforms received twin-pulses [illegible] synchronised with the second pulses of the twins. These single pulses prove the modulation of transmitter of ground-responder beacon, which transmitts by the transmitting antenna respond-pulses. Respond-pulses of the responder-beacon are received by the receiver of airborne DME, amplified and fed to the input of search and measuring circuits of DME. On this input are fed also the interrogation pulses of transmitter.

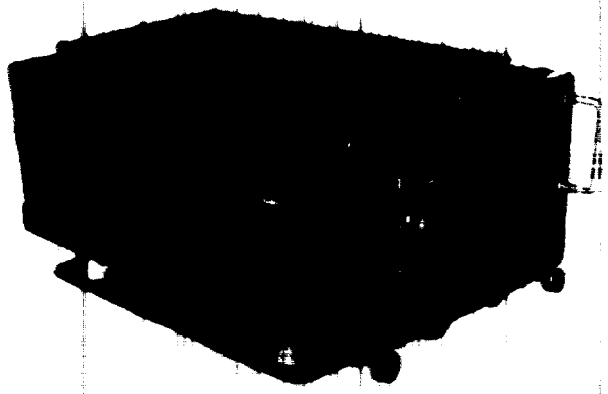


Fig. No 50

Between the interrogation pulses of distance measuring equipment and between the respond-pulses of ground-responder beacon there is a time-delay /t/, directly proportional to the distance between the aircraft and responder beacon.

Measuring circuits of distance-measuring equipment produce a voltage proportional to the time delay between interrogation-pulses and responses. The voltage is fed to the distance indicator, designed as a d.c.-instrument graduated in kilometres.

Location, removal and installation.

Receiving and transmitting units are located in the lower front part of aft compartment and screw-fasteners secure them to their shock-mountings.

Inverter MA-250 m is located in the lower front part of aft compartment in front of the receiving and transmitting units. Four screws fasten it to the shock mounts.

The receiving and transmitting antennas are located in the centre bottom part of fuselage: the receiving antenna close to the 33 fuselage frame and the transmitting antenna close to the 37 fuselage frame is located. Three screws fasten each antenna to the fuselage surface. Before removing the receiving antenna of distance-measuring equipment remove the cover of the opening called "Electrical connector", dive the arm into the opening and disconnect the high-frequency cable from antenna. The antenna feeder must be disconnected also before removing the bottom cover of fuselage. The feeder connector of transmitting antenna is accessible from the aft compartment.

Distance and orbit indicator PRD-50 is located on the pilot's instrument panel. Remote control box of distance-measuring equipment is located on the pilot's right hand panel.

Remote control box and indicator of distance-measuring equipment SD-1.

For controlling the operation of distance-measuring equipment a remote control box and indicator unit are provided.

On the remote control box following controls are located /Fig.51/:

1/ turn-on used also for selection of operation channel

2/ orbit-number selector lever

3/ push-button "Tuning"

4/ control knob "Zero adjustment"

5/ control knob "Calibration 30-150 km"

6/ control knob "Orbit calibration"

7/ indicator lamp "Code" or "Interrogation signal"

8/ Indicator lamp "On".

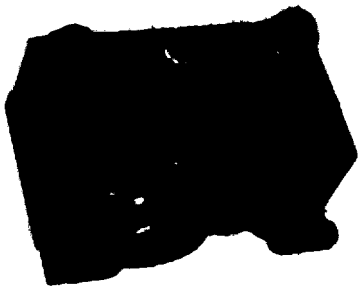


Fig. No 51: Control panel.

The turn-on lever also switches on the starting relays and the desired operation channel. The first left position is the turn-off-position, the other three positions select the operation channel.

The orbit-selector switch has six positions corresponding to six different circle patterns. The "tuning" button is used for suppressing interference caused by an undesired responder operating on the same channel as the desired responder if the distance between both responders is shorter than 15 km. A simple pressing of the control-knob is required for tuning.

Control-knob "Zero-adjustment" and "Calibration 30-150 km" are used for correcting the zero position and full-scale position of indicator pointer. If correction of pointer position is required, press the control-knob and turn it until the desi-

red pointer position is obtained.

The control-knob "Orbit calibration" is structurally similar to the knobs "Zero adjustment" and "Calibration 30-150 km" and it differs only by the number of contact springs. All knobs are conjugate with corresponding potentiometres of measuring circuit. It is possible to adjust the potentiometers only after the knob was depressed. On the control box an indicator lamp "On" and an indicator lamp "Code" are located.

On the indicator unit two controls are installed. "On" of the two controls is used for selecting the desired range and it is marked with inscription "Range". When turning this control all scale numbers are changed. The first range corresponds to distance up to 30 km and the scale is graduated approximately 0, 10, 12 and 30 km, one scale unit corresponding to 500 m. The second range reaches 150 km and the scale is graduated also appropriately 0, 50, 100 and 150 km, one scale unit corresponding to 2,5 km.

The other control is called "Function" and it switches the distance measuring equipment either for distance measuring operation or for circle-pattern /orbit/ operation. According to the movement of this control the function selector relay in receiver is operated. By turning this control the inscription in the lower part of indicator dial is also changed. Inscription "Orbit" indicates the circle patter-flying operation, inscription "km" indicates the distance-measuring operation.

Both the distance and the orbit position are indicated by the same pointer. For circle-pattern flying the lower scale is used. In its centre is a zero-mark. Inscriptions "L" and "P" are on the left and on the right from zero-mark. When "On orbit" the pointer indicates to zero-mark of orbit scale.

Equipment PSBN-M.

Instrument bombing and navigation equipment PSBN-M is a radar bomb-aiming sight. It is used for ground- and sea-target bombing as well as for navigation using ground orientation points and radar beacons during instrument flight conditions. Radar aiming PSBN-M is synchronized with the optical aiming sight OPB-65 R.

Aiming-right pictures on the screens of plan-position-indicator any object within the operation range of the equipment. Coordinates of the pictured marks /ground constructions, coasts, basins, ships/ are given by the slant-distance and relative bearing /angle between the aircraft axis and direction to the mark/ /KU/.

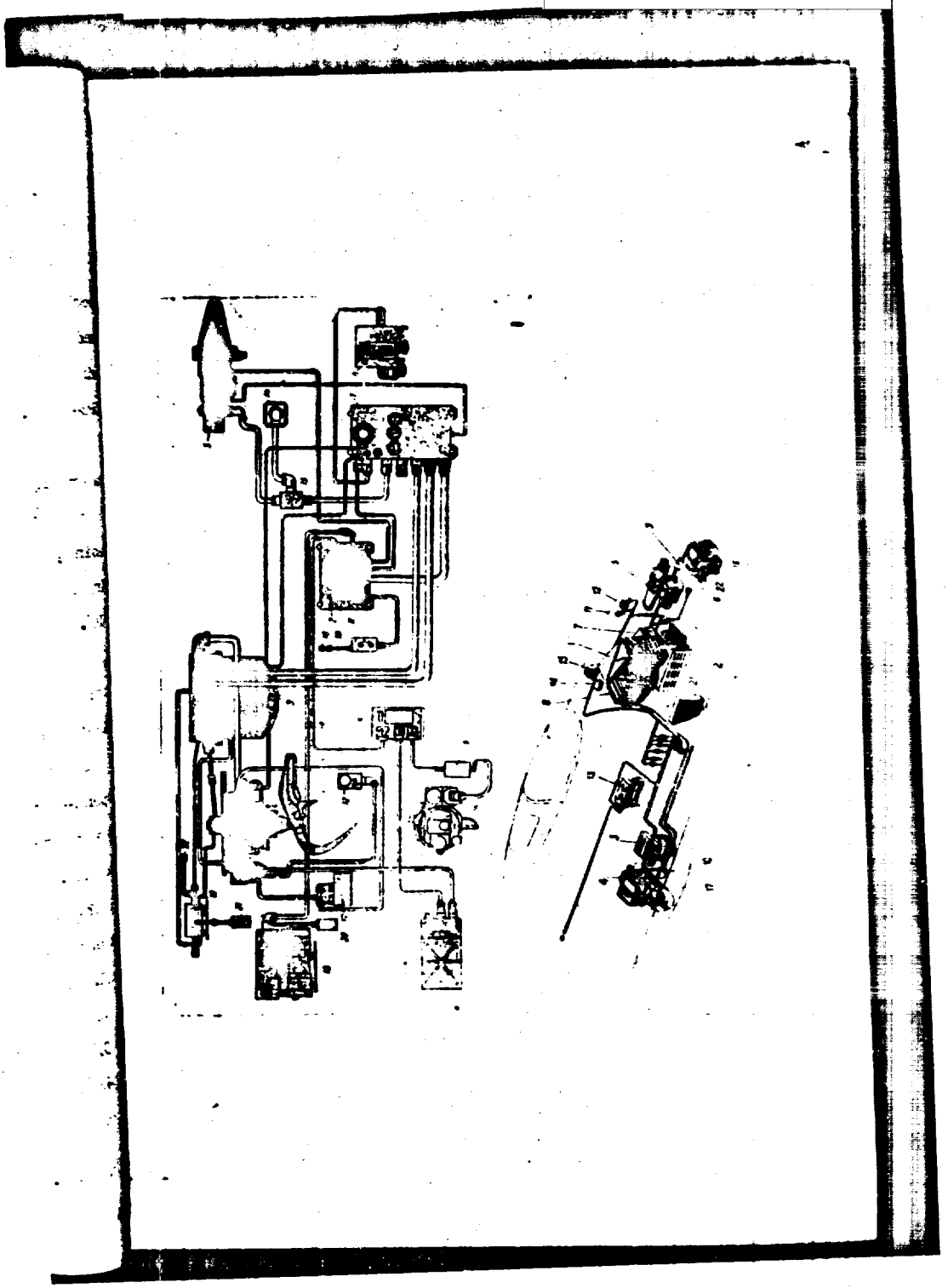
Bombing problems are solved by the computer, which is part of the radar-aiming-sight or by the computer of optical aiming--sight OPB-6 SR synchronized with the radar aiming-sight.

Special radar beacons installed on the ground may produce respond-marks on the plan-position-indicator /after switching the equipment int "Beacon-operation" and enables to reckon the position.

The radar aiming-sight PSBN-M consists of following component units:

1/ main control unit
2/ power supply
3/ transmitter
4/ scanner /antenna unit/
5/ plan-position-indicator

Fig. No 52 ..... see page No 73.



6/ computer

7/ synchronizer of OPB-6SR

8/ calibration box of synchronizer

9/ azimuth stabilizer unit

10/ air-compressor with reductor

11/ control box of inverter MA-k500 K

12/ sector detecting box

13/ inverter MA-1500 K

14/ indicator tube equivalent

Radar aiming-sight works by transmitting signals which are reflected from the objects on their way back to the receiver.

The directional parabolic antenna has a fan-beam pattern, 2,8° - 3° width. It searches thoroughly the space under the aircraft fuselage up to horizontal plane.

Antenna transmitts periodically pulses of high-frequency energy fed by wave-guide-system and 3-c,-magnetron generator. The latter is the substantially part of transmitter.

Recurrence rate of magnetron emissions is given by the distance unit producing impulses for trigerring the transmitter controlled by a crystal oscillator with high stability.

Radio-waves radiated by the antenna propagate straightly with a speed about 300.000 km/sec. After reaching the ground, the radio-waves are diffused by the earth-surface and by the objects on the ground. A part of the electromagnetic energy, quantity of which is in accordance with the reflecting characteristic of different objects and surfaces, is reflected and after returning to the receiver it is picked up by the antenna. A special antenna switch enables to use the scanner as the transmitting antenna and also as a receiving antenna.

The propagation velocity of electromagnetic waves is constant. The time interval between transmission of pulse and reception of echo-pulse is therefore proportional to the distance of object. Time delay of 6,67 microseconds corresponds to a distance of 1 km.

Reflected echo-signals picked-up by the antenna are put to the receiving equipment consisting of following parts: mixer-detector, klystron oscillator, intermediate frequency amplifier and video-amplifier. The echo-signals are fed from the video-output to the cathode ray tube of plan-position-indicator. The deflection pattern of the indicator tube is radial, i.e. the electron beam sweeps in thetube from the centre of screen radially to the trim and traces a fluorescent line, whose brightness corresponds to the received echos.

The direction of the trace is synchronized by means of a special rotary transformer /selsyn-transformer/ with the azimuth scanner. When the scanner does not move, only a small stripe /width of which equals to the beam width 3°/ of earth surface will be swept with the electromagnetic beam. The whole earth surface up to a distance corresponding to the operation range of equipment will be swept progressively when the scanner rotates.

The trigger-frequency of electron-beam in indicator tube equals to pulse recurrence frequency of transmitter. The pulse-transmission is therefore synchronised with the trigger of the electron-beam and the direction of the trace is synchronised with the azimuth of scanner.

Amplitudes of the reflected signals are proportionnal to the reflection characteristics of different objects.

The indicator tube has a long-brighting screen /fluorescention endurance 5-10 sec/. During the one revolt of antenna will be the echo-spots heaped and on the screen appears a radar-map consisting of right and black spots. On this map the whole earth surface within the operation range of equipment is plotted.

Different constructions, railway-bridger, ships, mountains, etc. appear on the indicator screen in form of brighting spots.

Water surface /rivers, lakes, sea/ causes specular reflection of electromagnetic energy and produces black images on the indicator -tube. Boundary between land and water forms characteristical coastel-lines. By observing the grouping of spots and their brightness, it may be possible to estimate the character of plotted objects.

The antenna radiation pattern in the vertical plane is designed so that near as well as distant targets will produce equal brightness of spots on the plan-position-indicator.

The relative bearings of targets are determined in relation to a special radial trace indicating the aircraft heading on the PPI-tube.

This trace enables to determine the relative bearings of targets using a special optical filter and azimuth scale. Sweeping of the sector between 60 and 300 degrees is provided for observing only certain parts of earth-surface. When this operation mode was selected, the antenna sweeps only in limits mentioned above. This operation is used mainly for bombing.

For measuring the distance between aircraft and different ground objects and also for flight altitude measuring, calibration marks corresponding to distance of 2,10 and 20 km by the range unit are produced. A special measuring pulse controlling

the aiming computer is also produced. The slant range is indicated on the dial.

The computer makes also possible to locate the measuring circle on the screen so, that coincidence of the circle and of the selected target determines the moment for bomb jetissoning.

If the equipment cooperates with the optical bomb-aiming--sight, the computer of the later is used and on the screen of PPI appears on "Electronic aim".

Radar-aiming is modified in this system so, that the space projected on the PPI-tube equals to that of optical aiming-sight OPB/6SR. Optical aiming system of OPB-6SR substitutes also the PPI. By adjusting the same controls of OPB-6SR, the navigator may aim using optical system of OPB-6SR or using the PPI of radar-aiming-sight.

Outline characteristics of PSBN-M.

1/ Radar aiming-sight pictures on the screen of plan-position-indicator the earth surface, ground- and sea-targets. It enables to detect the target and determines the moment for bomb jettisoning in all altitudes between 900 and 13 000 metres and airspeed between 300 - 900 km/h.

2/ It provides both circular and sector searching, for sector searching a sector from 60 to 300 degrees in any ditection may be selected.

3/ Detects industrial centres and cities up to distance 70 - 100 km and ships up to 40-50 km.

4/ Enables approach to pulse-beacons.

5/ Measures flight altitude from 900 to 13 000 metres with accuracy of 100 m.

6/ One navigator attends the radar aiming-sight.

7/ Operation frequency 9370 ± 30 MC /wave-length 3,2 cm./.

8/ Pulse-output of transmitter 60-70 kW.

9/ Pulse length: for bombing /range 8-60 km/ - 0,35 microsec
for detecting /range 100-200 km/ 1 microsec
for beacon operation - 2 microsec.

10/ Width of antenna pattern in horizontal plane - 3 degrees. Antenna radiation pattern in vertical plane - fan defined by the law cos Θ where Θ angle of object.

11/ Scanner rotates slowly with 9-17 r.p.m. or rapidly with 19-28 r.p.m. If it sweeps in a sector only, it makes 50-80 or 70-120 cycles per minute.

The inclination of scanner may be changed according to the angle of object in limits 5° upwards and 20° downwards from horizontal level.

12/ Two plan-position-indicator tubes may be provided. If only one tube is used, the other is substituted by an equivalent.

13/ The start-point of trace on the PPI tube may be selected

a/ continuously in the range 8-60 km enables changes in limits from + 40 km /centre closed/ to -15 km /centre opened/ in relation to the transmitter pulse,

b/ in steps in the ranges 100 and 200 km enables changes in limits 0 - 220 km /detection/ and 0-300 km /beacon/ by steps of 20 km.

14/ The receiver is equipped with delayed gain control for keeping constant brightness for tracing near and distant targets. Both automatic frequency control and manual frequency adjustment are provided.

15/ Special compiter produces on the PPI-screen a measuring mark according to given data for bombing. The coincidence of the mark with the selected target determines the moment for

bomb jettisoning. Using this computer it is possible to determine accurately the altitude and also the distance to any selected object or target within the range up to 30 km. The computer enables proper adjusting of start-point of trace in relation to the interrogation signal.

16/ Cooperation with the optical aiming-sight OPB-6SR is provided. During the cooperation the computer of the optical equipment is used.

17/ Direct reading instruments /transmitting magnetron rectifier current indicator, detector current indicator, input voltage -115 v 400 cps indicator; scanner tank angle indicator and a cathode-ray tube are used for checking the operation of different units.

Equipment obtains required d.c. input power from electrical system of aircraft. Inverter MA-1500 K supplies a.c. voltage /115 v 40 cpr/.

18/ Power consumption not exceeding 2,5 kW.

19/ Transmitter pulse length, pulse recurrence rate and the mean magnetron current depend upon the operation-mode selected. For normal input following values are obtained:

| Operation | Range in km | Pulse recurrence frequency | Pulse length | Magnetron current |
|---|---|---|---|---|
| "Detecting" | 8-60 | 1250 pps | 0,3 - 0,4 microsec. | 6-8 mamp. |
| "Detecting" | 100 or 200 | 577 pps | 0,9 - 1,1 microsec. | 10 mamp. |
| "Beacon" | 8-60; 100; 200 | 300 pps | 1,9 - 2,2 microsec. | over 9 mamp. |

20/ Mean power output of transmitter over 36 watts for pulse length of 1 microsecond and pulse recurrence frequency 577 pps.

21/ Receiver sensitivity over 90 dB for 1 milivatt.

22/ Intermediate frequency of receiver 30 ± MC.

23/ Intermediate frequency amplifier pass band for 3 dB down over 3,8 MC.

24/ Maximum detector current measured by the instrument on the main control box should be within the limits 0,4 - 0,9 miliamperes. Detector current should be 75-05 percent of max. current when klystron is pre-tuned for altitude operation.

25/ Range of suppression of superfluous brightness of screen picture /range of delayed gain control/ over 15 km.

26/ Standing wave ration not over 1,43.

27/ Scanner rotating speed for circular operation

fast 19 - 28 r.p.m.

slow 9 - 17 r.p.m.

28/ Swinging speed of scanner for sector operation /60 degr./

fast 70 - 120 cycles per minute

slow 50 - 80 cycles per minute

29/ Scanner inclination

upwards over 5 dgr.

downwards over 20 dgr.

30/ Range 1/ from 8±1 to 60±5 km scale may be changed continuously

2/ 100 km

3/ 200 ± 10 km

31/ Dividing ratios of crystal-oscillator frequency in distance unit 1:1; 1:2; 1:5; 1:6 /for range 10-60/; 1:13 /for range 100 or 200/ and 1:25 /for "beacon" operation/. Ratio 1:24 or 1:26 may be also obtained.

32/ Continuous control of trace-start-point operates within limits from -15 to +40 km.

33/ Range for determining distance using computer between 1 to 30 km.

34/ Distance reading accuracy using computer

from 2 to 14 km better than ± 100 m

from 15 to 28 km better than ± 200 m

35/ Constant error caused by pulse delay in transmitter and receiver not over 250 m.

36/ Difference between the direction of trace on PPI-tube and scanner-position

maximum error not over 4 degr.

mean square error not over 2 degr.

37/ Deviation angle of optical aiming-sight OPB-6SR is transferred to the stator of selsyntransformer of PSBN-M with an error not exceeding

0,5 degr. for deviation angles up to ± 20 degrees

1 degr. for deviation angles between ± 20 and ± 30 degr.

38/ Angle error of lateral stabilization of synchronizer with OPB:

for bank angle up to ± 10° not over 1 degr.

for bank angle exceeding ±10° not over 3 degr.

39/ Slant-range synchronization error for aiming-angles up to 60 degrees

for altitude below 4000 m not over ± 80 m

for altitude above 4000 m not over 2 percent of indicated altitude,

40/ Deviation angle adjusting speed of optical aiming sight when adjusted by the synchronizer unit not over 4,5 degr/sec,

41/ Air-pressure in transmitting unit 0,4 atm,

42/ Pressure decrease in transmitter during 10 hours not over 0,2 atm.

43/ Air-pressure in wave-guide system 1-1,2 atm.

44/ Pressure decrease in wave-guide system during 15 minutes not over 0,2 atm.

T r a n s m i t t e r.

Transmitter of equipment /Fig.53/ consists of oscillator, modulator and timer.

For oscillator a magnetron type MI-5 with 100 kW pulse-power and 3,2 cm wave length is used. Remote control from control box is provided.

Transmitter unit has a square block chassis. Modulator and timer with their power suppling are located beyond the chassis in a pressure-tight case. The timer with its rectifier is designed as a separate unit connected to the transmitter by a special connector. This makes the servicing easy. In the inner of chassis following parts are located:

magnetron and its magnet,

blower for magnetron cooling,

starting relay,

wave-guide,

interconnecting link between antenna and magnetron,

receiver head.

Magnetron current and rectifier current are checked by an instrument on the front panel of main control box.

Scanner assembly.

The antenna is conjugated with the antenna moving mechanism and fixed to a special frame /Fig.54/.

Scanner assembly consists of

1/ parabolic antenna in a radome 240 mm height

[illegible] elevation mechanism

[illegible] elevation potentiometer for transmitting the [illegible] angle to the instrument on the front panel of the junction box,

4/ differential azimuth unit consisting of driving motor, selsyn transformer , sector [illegible] and differential mechanism

5/ antenna position contact

6/ azimuth adjusting mechanism consisting of motor with worm gear.

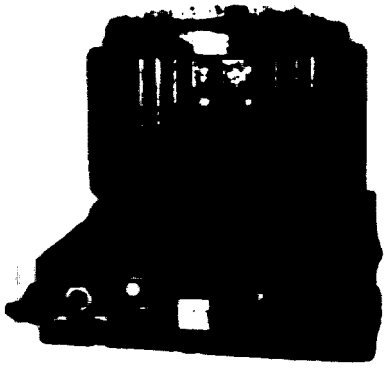


Fig. No 59: Transmitter PSN-4.

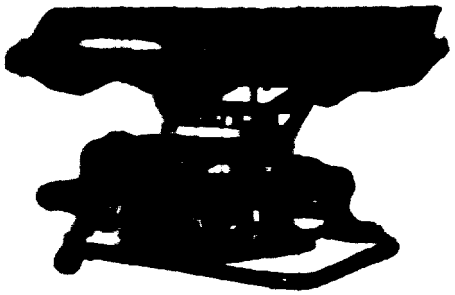


Fig. No 54: Antenna PSN-4.

M in control box.

All controls of equipment PSBN-M are located on the front panel of the main control box /Fig. 55/. The main control box contains also the intermediate frequency amplifier, the second detector, video amplifier, automatic frequency control of klystron oscillator and delayed gain control of receiver. The high frequency stages of receiver consisting of first detector, two klystrons and two stages of intermediate frequency pre-amplifier are located in the transmitter. Detector current is measured by a miliamperemeter on the front panel.

Fig. No 55: Resp

The control
quency unit, dis
separate chassis
is secured to the front panel.

The adjustment elements of distance units are accessible through the holes on the right side of case.

Fig. No. 2

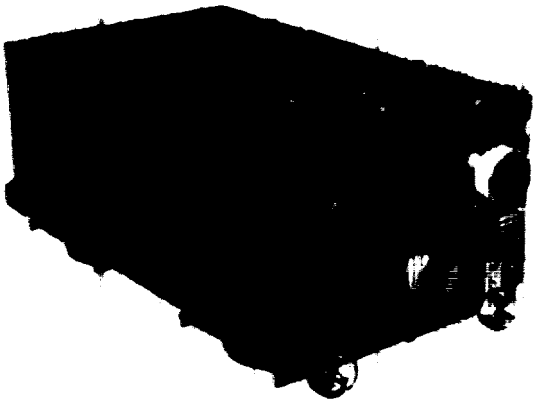


Fig. No. 3

Power

The [illegible] of power supply unit /Fig.5&/ contains [illegible] supplies plate voltage for stages in the [illegible]

Azimuth stabilizer.

[illegible] of azimuth stabilizer unit /Fig.17/ [illegible]

a moment - amplifier and a selvyn for zero adjustment of heading line. Switch for turning on the stabilizer is located on the control box panel.

The equipment is supplied by the inverter MA-150.

Location of the equipment units in the aircraft.

Transmitter of the radar-aiming sight is located on the bottom of fuselage between the 11th and 13th fuselage frame. The transmitter is fastened by shock mounts in such a way, that quick removal and easy access for checking up and repairing the unit is guaranteed.

Six screws fasten the transmitter to its mounting which is fixed to a frame secured to shock mounts.

The scanner is located behind the transmitter on the bottom of fuselage between the 14th and 15th fuselage frame. The scanner is fixed by four rubber shock mounts, type 271549.

For making the access to the receiver and the scanner easy, an opening on the bottom of fuselage between the 12th and 16th frame is provided. The opening is covered with a radome 15 mm thick made of foam-polystrol. The radome is secured to the aircraft structure by screws. The scanner is accessible only after removing the radome. Main control-box is located on the left side of navigator compartment. It is fixed to a special support secured to the aircraft structure. On the left side of control box /relating to front panel/ the sockets for cable connections are located.

The plan-position-indicator /Fig.58/ is located on a movable support on the left side of navigator compartment. This support enables

a/ to turn the tube in the horizontal plane

[illegible] the tube in the vertical plane

[illegible] the lower th[illegible] tube beyond the table

Four [illegible] stock [illegible] 27154 fasten the tube to the [illegible] up[illegible].

Power supply unit is located beyond the support [illegible] in control [illegible] on [illegible] special chassis secured to the floor of navig[illegible]tor's compartment.

Ad[illegible]tion stabilizer is secured beside the main control box by [illegible]ans of shock mounts type 27154[illegible].

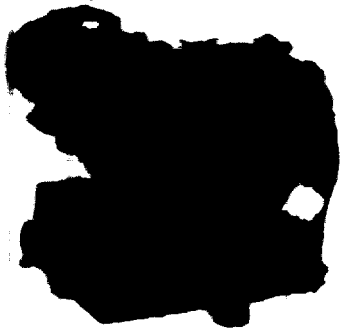


Fig. No 58: PPI Indicator tube PSBN-M

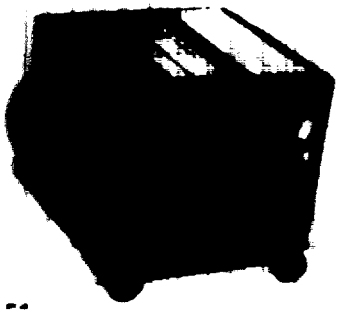


Fig. No 59: Calculator PSBN-M

Computing unit /Fig.59/ is located on the left hand [illegible] of navigator's compartment. It is fixed by holders to [illegible] shock mountings.

S[illegible] unit /Fig.6 / and inverter [illegible] /Fig.6/ are located on the left side of cockpit. Syn[illegible] unit of [illegible]SR /Fig.6/ is located on the support ba[illegible] in control box. Calibration box /Fig.63/ is located [illegible] left hand table of navigator. The control potentiometer [illegible] conveniently accessible. Air-compressor /Fig.64/ is located [illegible] to the transmitter.

Fig. No 62: Sector searching panel.

Fig. No 63: Converter control panel.

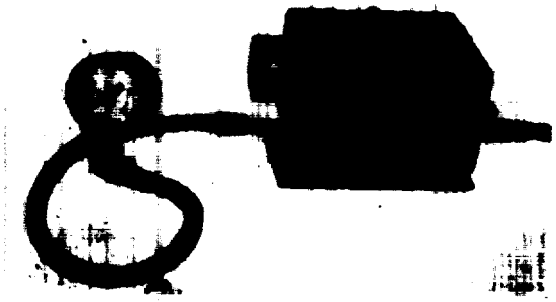


Fig. No 63: Air suction.

Fig. No 63: Block of communication with OPB-6 SP

Fig. No 64: Calibrating head of block of communication with OPB-6 SP

Airborne radar responder /SRO/

Airborne radar responder SRO is a responder belonging to the independent identification system. It receives interrogation signals and transmits automatically the respond-signals proper code.

Responder may operate in conjunction with aircraft-, ground-

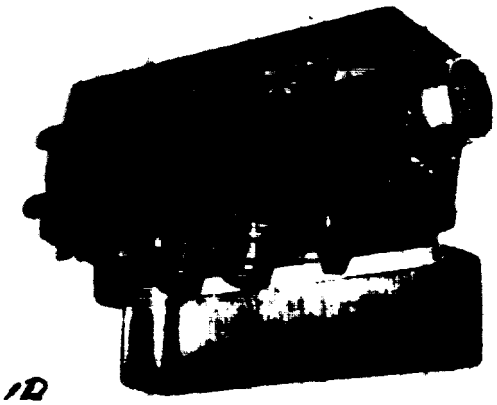


Fig. No 64: Calibrating panel of block of communication with OPB-6 SP

and ship-interrogators.

The responder set SRO enables the friend-or-foe identification and the distance measuring.

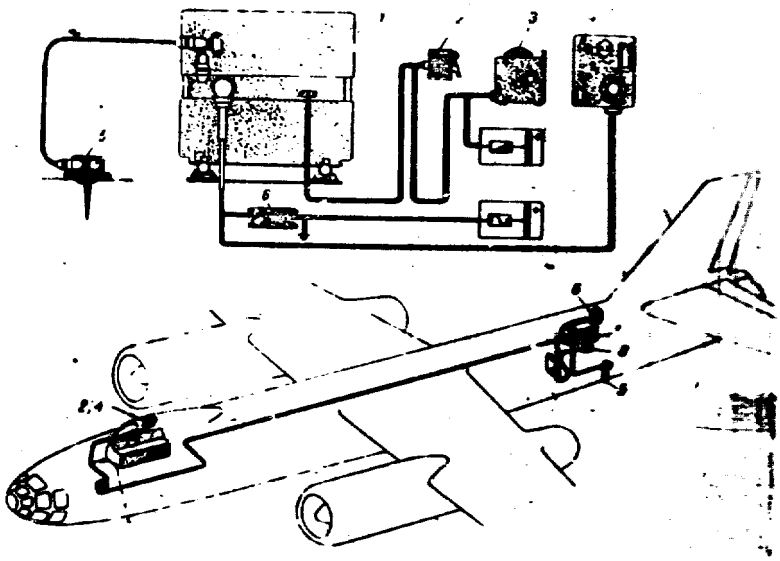


Fig. No 65: Diagram showing connection and location of blocks SRO.

1/- transceiver, 2/- detonator knob, 3/- inertia switch, 4/- code ; 1 - blocking relay of accumulators, 2 - pilot's right panel

The question during the flight is fully automatical. Power input is obtained from the electrical d-c system of aircraft.

If the aircraft flies in the operation zone of interrogator, the responder receives its high-frequency signal and transmits coded responds.

Destroy the responder S O if the risk of capture by the enemy exists. For destruction and electrical detonator in the transmitter-receiver is located. The detonator is trigged by voltage and destructs the transmitter-receiver. The voltage is

fed to the detonator through the ignition button on the pilot's right hand panel.

If the pilot left the aircraft in emergency without destroying the responder, the equipment will be destroyed in case the aircraft hits the ground. In that moment the detonator will be trigged by the inertia switch.

Outline characteristics of responder type SRO.

1/ Number of codes: four and emergency signal, selected of the switch on code box.

2/ Frequency sweep range of transmitter-receiver 160-170 MC

3/ Duration of a sweeping cycle 0,6450,04 sec.

4/ Receiver sensitivity about 100-500 microvolts for pulse recurrence frequency 500 ppc.

5/ Receiver pass-band 2,5 - 6 MC

6/ Length of respond - pulse

a/ dot /narrow pulse/ 8 - 12 microsec

b/ dash /width pulse/ 20 - 30 microsec, dash-to-dot ratio over 2,5

c/ emergency signal from 40 to 70 microsec.

7/ Input voltage 27 volts ± 10 percent

8/ Total current drain not exceeding 5,5 amp, power consumption 155 watts

The responder equipment consists of following units:

1/ transmitter-receiver with power supply,

2/ code box

3/ antenna

4/ inertia switch

5/ ignition switch

6/ main filter FT-14

Transmitter-receiver /Transceiver unit/

Transceiver receives interrogation signals and responds automatically with coded identification signals.

Fig. No 67: Transceiver SRO.

Transceiver unit consists of two chassis, one of which contains the transmitter-receiver, the other parts the power supply. Both parts are coupled and covered with a case.

On the front panel on transceiver following details are located: 12-pins-socket for connecting the code box cable, two high-frequency receptacles for connecting the antenna feeder and the blocking cable of interrogator /it is installed on the aircraft/; socket for connecting the detonator to voltage [illegible].

The transceiver is located on a special chock mounting on the right side of aft compartment in its rear part between the 39th and 40th fuselage frame.

Code box.

Code box /Fig.68/ is used for code-selection and operation-checks of responder.

On the code box following controls are located: code selector switch, headset sockets for checking purpose, two indicator

[illegible], [illegible] control knob of indicator lamps, [illegible] [illegible] [illegible] switch /s and-by-respond/.

Fig. No 6a: Cole panel SRO.

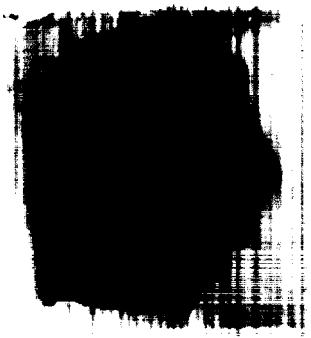


Fig. No 6b: Inertia switch SRO.

A n t e n n a .

Common antenna is used for picking-up the high-frequency interrogation signals and for radiation of respond pulses.

A short quarter-wave dipole is used. It is constructed as a 200 high. Antenn is secured to the bottom of fuselage between the 40th and 41st frame.

Ignition button.

The ignition button triggers the detonator in transceiver by connecting it to the source of voltage. The transceiver is

destructed in this way if the risk of capture by an enemy exists.

Inertia switch.

Inertia switch provides automatic triggering of detonato of the aircraft knocks against the ground in the case of aver ge.

Inertia switch is located below the mounting frame of trans-ceiver. Three screws fasten it to the support of CRO-transceiver.

P o w e r .

The required power is obtained from bus in the pilot's right hand panel through the circuit breaker AZS-15. Detonator circuit obtains voltage through an inertia protecting device IP-5 connected immediately to the battery terminal in battery relay box.

Such a connection of detonator circuit guaranteed reliable operation even through all power of electrical system are turned off, i.e. if the average switch on the pilot's left hand panel is turned off.

Interphone set SPU-5.

Interphone set SPU-5 /Fig.70/ provides telephone communication between crew members and it enables also radio-communication by connecting the crew helmet to appropriate communication or navigation equipment.

Using this set SPU-5 the pilot is able to telephone with the navigator and the gunner. It is also able to communicate by means of the command set RSIU-3M and liaison set RSB-5 and to listen to the radio-compass RK-5 reception.

The navigator using the set SPU-5 is able to telephone with the pilot and the gunner, it may use the command set RSIU-3M and radio-compass ARK-5 an interphone set enables him to listen to the communication of liaison set RSB-5.

The wireless-operator /gunner is able to telephone with the pilot and navigator, communicate using liaison set R-3 and listen to the command set RSIU - 3 M operation.

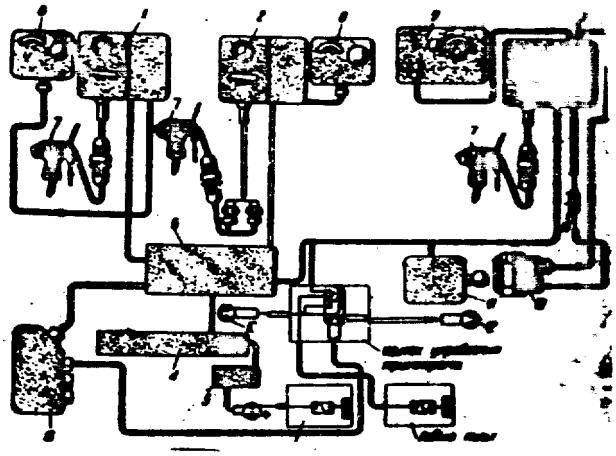


Fig. 11

1/- pi
gunner
4/-, 6/-
9/- re
RSB-5, 12/- transmitter switching push-button, 13/- control desk RSIU-3 M, 14/- switch of self-receiving.

In the compartment of transmitter PSBN-M there is located a helmet-cord-socket. During ground-checks and adjustment the SPU-5 enables communication between the radio-service-man and between navigator.

Interphone set SPU-5 consists of following parts:

1/ amplifier

2/ Three

3/ Junction box

4/ Dynamotor RU-11 AM.

SPU-5 operates on d.c. voltage supplied by the aircraft electrical system through the circuit breaker type AZS-5 located on the switch panel.

...e to telephone with
... RSB-5

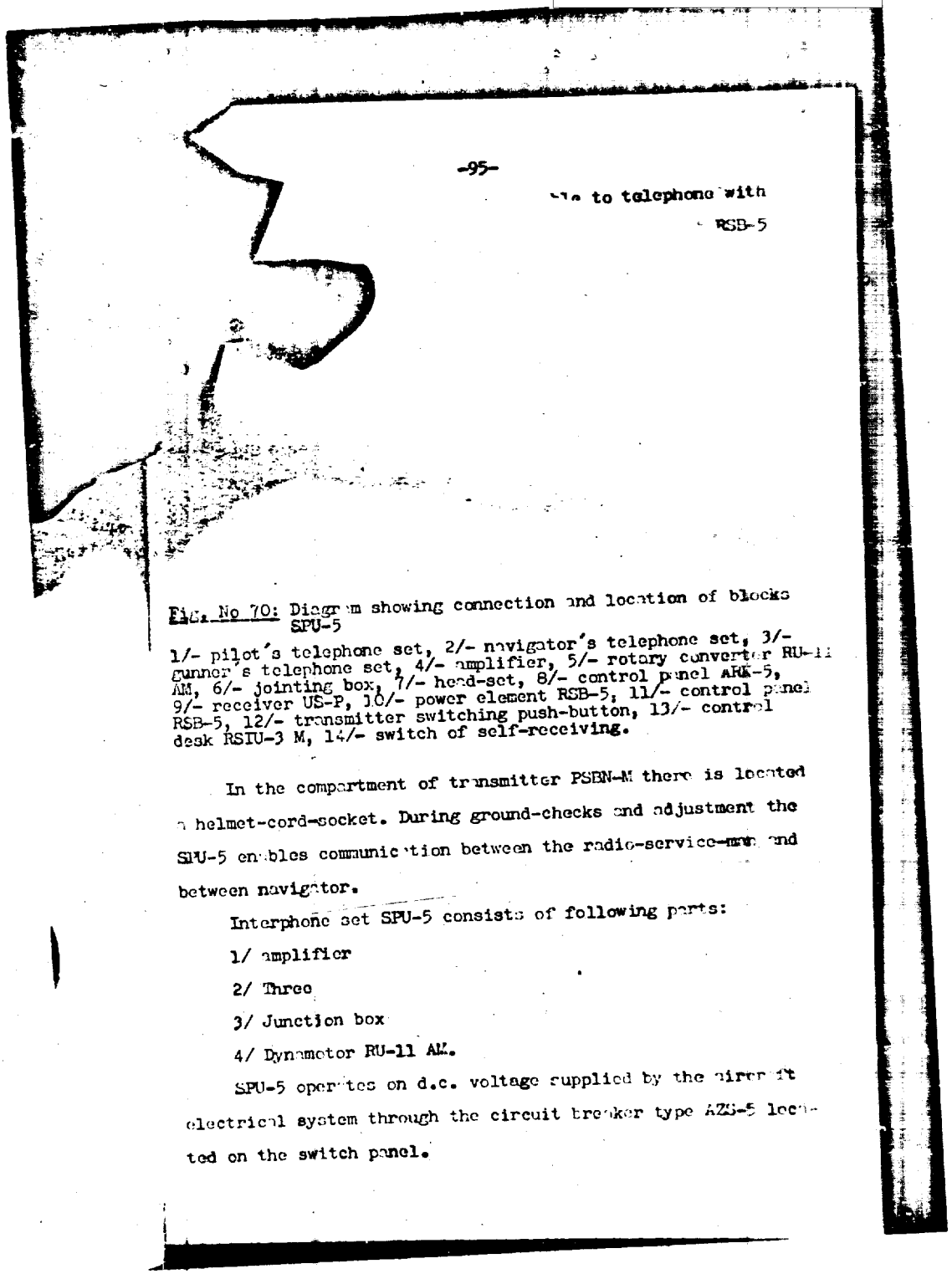


Fig. No 70: Diagram showing connection and location of blocks SPU-5

1/- pilot's telephone set, 2/- navigator's telephone set, 3/- gunner's telephone set, 4/- amplifier, 5/- rotary converter RU-11 AM, 6/- jointing box, 7/- head-set, 8/- control panel ARK-5, 9/- receiver US-P, 10/- power element RSB-5, 11/- control panel RSB-5, 12/- transmitter switching push-button, 13/- control desk RSIU-3 M, 14/- switch of self-receiving.

In the compartment of transmitter PSBN-M there is located a helmet-cord-socket. During ground-checks and adjustment the SPU-5 enables communication between the radio-service-man and between navigator.

Interphone set SPU-5 consists of following parts:

1/ amplifier

2/ Three

3/ Junction box

4/ Dynamotor RU-11 AM.

SPU-5 operates on d.c. voltage supplied by the aircraft electrical system through the circuit breaker type AZS-5 located on the switch panel.

Amplifier has three stages using vacuum tube type 6H7 - radio-frequence double triode.

Output power of amplifier - 3 watts.

For calling a crew-member communicating by radio, a special relay is located in the amplifier. This relay interconnect headset's of all crew-members regardless of the position of the selector switch on their box. The relay may be closed from any box by placing the selector switch into position "call".

The amplifier is mounted on an aluminium box. On its upper side a relay, tubes, and transformer are located. The other details are located in the inner of box. A metal cap fixed by four holders covers the upper part of box. A spring locks the volume control and prevents misadjustment by shocks and vibration. The bottom is covered with a metal plate connected by four rubber shocks mounts to the upper part of shock absorbing device. The lower part is fixed to the upper one by four holders.

Box /Fig. / is a selector-switching device which enables each crew-member to call any other crew member and to communicate with him. Switching for radio-operation is also provided.

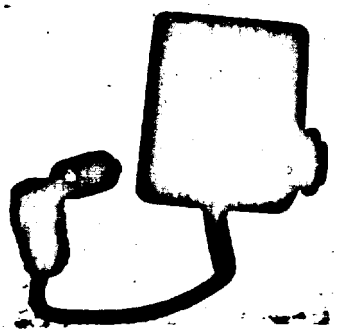


Fig. No 71: Telephone set SPU-5.

A selector switch is used for selecting different functions. The inscription on the switch signify following functions:

a/ PK-navigation sets

b/ KR-command radio-set

c/ CP-liaison radio-set

d/ CR-listen

e/ talk

f/ call

The "call" position is not locked and when releasing the knob, it springs automatically to the position "talk".

For helmet connection a cord with receptacle is designed. Control knob is located on the box provides volume control.

To the switch is also secured the resistance BC-360 ohms which is connected to the amplifier input when switch placed into positions "PK", "KP", "CP" and "CL". This resistance stabilisator the amplifier input and the laryngophone supply voltage. For connecting the box to the equipment, a terminal plate with 15 posts is provided. The box is metallic. Upper cover with selector switch, volume control and helmet cord is detachable and it is fixed to the mounting frame by two screws. The terminal plate is in the frame secured to the aircraft structure.

Junctions /sword contacts/ connect the switch and volume control with the terminal plate.

To the interphone set SPU-5 belongs also junction box for interconnecting cables of all units of this set.

Outline technical data.

1/ Output voltage of amplifier over 70 volts for output load consisting of three or six headsets type TA-4 and for in-

put voltage 0,15 volts 1000 cps.

2/ Laryngophone supply voltage should be in the limits 2,2 to 3,2 volts.

3/ Noise output voltage not over 0,4 volts for output load of three or six headsets when three of six laryngophones connected to the amplifier input.

4/ Primary source input 26 volts ± 10.

5/ Required current drain about 2,2 amps.

Location on the aircraft.

The amplifier is located on the left side of the navigator's compartment. It is secured to the support of radar responder. The amplifier chassis is secured to the support by four screws.

Navigator's box is located on the instrument panel on the left side of cockpit. Pilot's box is on the right hand panel. Gunner's box is on the right side of compartment on the 44 fuselage frame.

The headsets and laryngophones of crew-members are connected to any set using the box of interphone set, which has for this purpose a cord with receptacle. In the navigator's compartment on the upper side of right hand panel two sockets are located for connecting the headset and laryngophone. Sockets are connected to the box.

Dynamotor is located on the right side of navigator's compartment between the 4th and 5th fuselage frame. Two string-absorbers fasten the dynamotor to the aircraft structure.

Junction box of SPU is located on the radio-equipment-rack on the left side of navigator's compartment. Junction box is fixed by two screws.

Alternating current system.

General.

Alternating current system in the aircraft supplies voltage for radio-equipment /radio-compass ARK-5, radio-altimeter RV-1, command radio set RSIV-3M/. Main source of alternating current is inverter MA-150, as a reserve inverter MA-250 is used.

| Outline technical data of inverters | MA-500 | MA-250 |
|---|---|---|
| 1/ Primary source voltage | 26 volts±10% | 26 volts ±10 |
| 2/ A-C output voltage - 400 cps | 115 volts±5% | 115 volts±5% |
| 3/ Power output for power factor 0,9 | 500 volt-amp | 250 volt-amp. |
| 4/ Current drain | 36 amps | 22 amps |

Alternating current is distributed to the consumpters by the alternating current bus panel. In this panel reostats for controlling the inverter output voltage and fuse-links of A-C power consumpters are located. Wiring diagram of bus panel is shown in Fig.72.

b/ Location, installation and removal of A.C.power sources.

Inverter MA-500 is located on the right side of nose wheel compartment. For installation and removal it is accessible from this nose wheel compartment. When removing the inverter proceed as follows:

1/ Loosen the captive screw of cover of an opening on the right side of nose wheel compartment /hermet-socket/ and remove the cover.

2/ Loosen the nuts of terminal posts and remove the conductor terminals.

3/ Loosen the lock-ring of cable plug and disconnect the cable.

4/ Loosen the captive screw of inverter mounting frame and remove the inverter.

Invertor MA-250 is located in the navigator's compartment above the switch panel. For checking or replacing the fuse of alternating current circuit, press the head of fastener, turn it counter-clockwise and remove the cover of panel. In the alternating current bus panel /Fig.72/ the fuses type PV-2 of the alternating current circuits of radio compass ARK-5, radio altimeter RV-10, command radio set RSIV-3M and voltmeter type EV-46 are located. One spare fuse is also located in the bus panel.

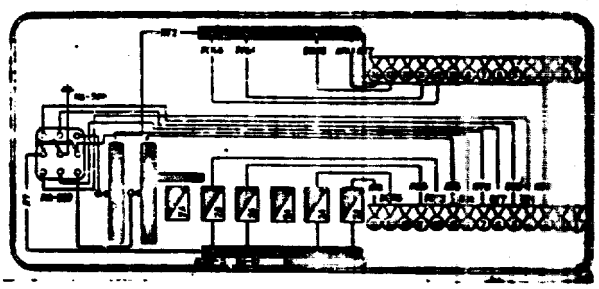


Fig. No 72:

c/ Checks and voltage adjustments of inverters.

1/ Turn on the circuit breakers /AZS/ "Radio-compass" and "Inverter MA-500" on the navigator's switch panel.

2/ Place the inverter selector switch into position "MA-500".

3/ Turn on the radio altimeter RV-10 and radio compass ARK-5.

4/ Check the alternating voltage by observing the voltmeter reading..It should be 112-118 volts. If it exceeds these limits, adjust it.

5/ Loosen the screw fastening the cover of adjusting resistances on A.C. panel and remove the cover.

6/ Loose a little the screw of slide-contact of variable resistance with inscription MA-500 and adjust the slide-contact for obtaining proper voltage 115 volts.

7/ Adjust the inverter MA-500 in the same way. If the output voltage of any inverter exceeds 150 volts and it is not possible to decrease it by adjusting the resistance, the carbon-regulator of inverter is dammaged. Remove the inverter from aircraft and send it in the shop. The inverter should not run without load as this will cause fault in carbon voltage-regulator. After turning on the inverter the consumpter should be turned on immediately.

Radio-reception disturbances and noise-level measurement.

Main sources of redio-reception disturbances caused by the electrical system are following equipments:

1/ IL-K 6 turret assembly

2/ Generators GSR-9000

3/ Motor D-200 of fuel over-pumping system EPK-4

4/ Motor MEP-3 of fuel pump PN-45

5/ Inverter PAG-1 f of distand reading compass DGMK-3

6/ Dynamotors RV-11 AM of radio-receiver US-P, interphone set SPU-5 and radio altimeter RV-2

7/ Inverters MA-500 and MA-250 supplying ARK-5, RSIU-3 and RV-10

8/ Dynamotors U-18-1 of receivers GRP-2 and KRP-F

9/ Inverter MA-250 of radio-distance-measuring equipment SD-1.

10/ Inverter ZPP-40 of radar identification set SRO

11/ Inverter MA-1500 of radar aiming sight PSBN-M.

Noise-level in the aircraft is measured on the output of

receiver US-P, following procedure:

1. In parallel with the headset connect to the headset terminal of receiver US-P the outputmeter IV-4 or alternating current voltmeter of set KSP-L.

2. Turn on the receiver US-9 and adjust it for a frequency on which no transmission of any station is heard.

NOTE: 1. For avoiding industrial interference, carry out the noise level measurement in such a time and on such a place that the external interference will be negligible.

2. Receiver used for noise-level measurement should meet all outline technical requirements.

3. Adjust the volume control for internal-noise output of 2 volts.

4. Turn on all consumpters producing radio-disturbance the instrument IL-K6 andmeasure the noise-level with the engine /one by one/ running. The noise-level should not exceed 5 volts.

5. If the noise-level exceeds the prescribed value, turn on the consumpters separately and determine which causes the greatest disturbance.

For making easy the detection of disturbance sources, measure the noise level when a group of consumpters only is on. When all consumpters turne on, the noise-level increases to 0, - 1 volt. If the engines are running the noise-level increases up to 0,5 - 2 volts.

Operation of one IL-K6 turret assembly causes increase of noise-level up to 12 - 20 volts..High noise-level may be caused by following faults: fault of supply filter network of one of sets, damage of bonding or cable shielding, sparkling of collector brushes if the collector is dirty, faulty operation brushes caused by unsufficient pressure etc.

If the noise level increases greatly during the flight, check immediately after the flight the bonding and the static-discharge string.

Instruction for operating and maintenance of radio equipment.

Preparation before flight.

The preparation before flight should proceed in the following order:

1/ Check the reliability of connection of the antenna to the lead through insulator of the station PC-5 /RSB-5/.

2/ In the cabin of the gunner-radio operator check:

- the mounting of the elements of the radio station RSB-5; of the receiver US-P and the telephone apparatus /SPU-5/;
- the reliability of contact of the plug sockets;
- the reliability and correctness of connection of the antenna leads to the terminals of the transmitter blocks, the antenna elements and the radio receiver;
- the reliability of the gastening and the correct connection of the plugs into the sockets of the receiver, the power and the antenna elements;
- the presence and the faultlessness of the spare fuses in the power element of the RSB-5;
- the presence of the "Tables for orientation for the tuning of the transmitter of the radio station RSB-5";
- the operation of the radio station RSB-5 receiver and transmitter RSB-5 in all modes of operation; after checking leave the radio station switched to "PRM".

3. Take off the lid of the back cover of the pilot's cabin and check the fastening of the receiver, the frame, the moisture absorbent, the radio compass ARK-5 and make sure of the reliable connection of the plug connectors and the durite strand.

4. In the cabin of the navigator check:

- the fastening of the amplifier and of the SPU-5, the distributing box, the control desk and the navigator's indicator of the radio compass ARK-5, the dynamotor MA-250;

- the reliability of connection of the plug connectors of the radio equipment;

- the presence and the faultlessness of the fuses and the spare fuses of the a.c. board;

- the presence and faultlessness of the illumination lamps of the control desk of the radio compass ARK-5;

- the reliability and the correct connection of the plugs into the sockets of the control desk of the radio compass and into the sockets "TEL" and "LRG" /Tlph. and Laryngoph./ of the right desk.

5. Switch on the automatic protecting devices in the supply circuits /AZS/ of the radio equipment on the board of the navigator. Switch on the dynamotor MA-500 and the radio compass ARK-5 and check, by means of the voltmeter, the a.c. voltage, which should equal to about 115 V.

Check the voltage of the dynamotor MA-250, the operation of the radio compass in all modes of operation and the operation of the SPU-5.

6. Check the fastening and the stretching of the antenna. Check the reliability of the connection of the antenna lead to the lead-through insulator of the radio compass.

7. In the cabin of the pilot check:

- the fastening of the control desk ARK-5 and of the indicator of the course angles of the pilot;

- the operation of the liaison radio station RSB-5 from the cabin of the course angles of the pilot.

9. Switch off the supply of the liaison radio station RSB-5.

10. Check the fastening of the antennas of the radio altimeters RV-2 and RV-10.

11. Take off the covers and check the fastening of the antennas of the IFF set and of the distance measuring set SD-1.

12. In the rear compartment check the fastening of the radio equipment and the reliability of connection of the plug connectors of the transceiver SRO, to the inertia switch and antenna of the SRO, the receiver and transmitter of the radio distance measuring set SD-1, the transceiver of the radio altimeter RV-10, the glide path receiver GRP-2 and the localiser receiver KRP-F. Take out the plug "VZRYV" /Detonation/ of the transceiver of the IFF set SRO.

13. In the bomb compartment check the fastening of the marker receiver MRP-48p, the transceiver and converter RU-11AM, the radio altimeter RV-2. Make sure that there is no moisture in the space of the antenna /inside the fuselage/ of the MRP-48p. If there is moisture present, take off the cover and drain the moisture.

14. Take off the cover of the compartment of the front s.c. leg and check the fastening of the blocks of the radio bomb aiming set PSBN-2. Make sure of reliable connection of plug connectors. Pump air onto the transmitter PSBN-2.

15. Check the fastening and the cleanness of the cover of the antenna of the PSBN-2. If rust in present, wipe the cover with a cloth, moistened with water /it is not allowed to use

petrol/.

15. In the cabin of the pilot check the fastening of: the control boards of the radio IFF set SRO, the radio distance measuring set SD-1, the glide path and the localiser receiver, the indicators of the radio altimeter RV-2, the radio distance measuring set SD-1 and the glide path and the localizer receivers PSP-48.

16. Fix the desired code by means of the switch on the board of the IFF set SRO. Switch on the automatic net protecting devices. Push the button "VZRYV" /Detonation/ and, after the pilot lamp begins to shine, check the faultlessness of the circuit of the IFF set detonator. /The plug "VZRYV" /Detonation/ should be disconnected from the detonator.

17. Switch on the radio altimeter RV-2 and check the zero position of the indicator pointer on the low altitude range. Check the switching of the ranges on the indicator RV-2.

18. Fix the necessary number of the fixed frequency on the control desk of the glide-path and localizer receivers M-50; switch on their supplies, and make sure, that the indicators show a deflection, when indicating operation of ground glide-path and localizer markers, and that the openings of the defect-signals are covered by black shutters. Push the button "Checking" on the control desk of the M-50, and check the zero position of the pointer of the indicator of the localizer receiver.

19. Switch on the supply of the radio distance measuring set and check its operation and calibration.

20. Switch off the automatic protecting devices of the net of SP indicator of the RV-10 in the navigator's cabin. Make sure of reliably connection of the plug connectors.

22. Switch on the supply of the radio altimeter RV-10, and

check its operation and adjustment.

23. Check the operation of the radio bomb aiming set PSBN-2 as shown in chapter III, § 3, after having connected to the board net and aerodrome source of electric energy, of power not less than 3 kW.

24. Before starting, connect the detonator and plug "VZRYV" of the transceiver of the IFF set SRO.

Operations after flight.

1. Check the reliability of the connection of the antenna lead to the lead-through insulator of the RSB-5 and make sure, that the insulator and its antifreeze cover are not damaged.

2. In the rear compartment check the reliability of the connection of the antenna lead to the lead-through insulators. Make sure, that the porcelain beads of the antenna lead, the lead-through and the supporting insulators are clean.

3. In the cabin of the gunner-radio operator check:

- the fastening of all the equipment. Pay special attention to the fastening of the power element RSB-5 and to the lock nuts of the receiver US-P locks;

- the reliability of the connection of the antenna lead to the transmitter blocks, the antenna element and the receiver to the lead-through insulator; make sure that the porcelain beads of the antenna lead and the supporting insulators are clean;

- the connecting of the plug connectors and the fastening of the cables of the equipment;

- whether the equipment has no outer signs of damage.

4. In the bomb compartment check the reliability of the connection of the plug connectors and the fastening of the conductor stands of the equipment.

5. Check the stretching of the antennas of the sets ARK-5 and RSB-5, check, whether the end insulators of the antenna and the anti-freeze covers show no outer signs of damage. Make sure, that the connection of the antenna lead to the lead-through insulator of the radio compass ARK-5 is reliable.

6. Through the opening in the cover of the pilots cabin check the fastening of the receiver and of the frame with the moisture absorbent of the radio compass ARK-5 make sure of the reliability of the connection of the plug connectors and the antenna lead.

7. In the navigator's cabin check:

- the fastening of the radio equipment, and whether the equipment shows any outer signs of mechanical damage;

- the reliability of the connection of the plug connectors and the fastening of the cables of the radio equipment and the elastic shaft of the radio compass;

- the reliability of operation of the switches MA-50C. - OFF - MA 250 /the a.c. voltmeter, the telephone apparatus SPU-5 and the control desk of the radio compass;

in the a.c. board - the faultlessness of the melting fuses and their fastening in the fuse blocks; check the presence of a spare fuse.

8. In the pilots cabin check:

- the fastening of the control desk of the radio compass ARK-5;

- the fastening of the elastic shaft of the radio compass.

9. Remove all defects detected during the flight and the inspection.

10. Check, under currents, the operation of all the equipment.

11. Check the fastening of the antennas of the radio altimeters RV-2 and RV-10 and make sure, that they are not mechanically damaged. Make sure, that the white insulating ring of the antenna is clean.

12. Check the fastening of the antennas of the radio distance measuring set and of the IFF set SRO and make sure that they are not mechanically damaged. Pay attention to the covers of the radio distance measuring set antennas.

13. Check the fastening of the cover of the PSBN-M antenna and make sure, that it is not mechanically damaged. If the cover is stained with rust, oil, etc., wash it with warm water and soap.

14. In the rear compartment check:

- the fastening and the mechanical faultlessness of the transceiver and the inertia switch of the IFF set SRO, the receiver and transmitter of the distance measuring set SD-1, the dynamotor MA-250, the transceiver RV-10, the localizer receiver KRP-F, the glide path receiver GRP-2 andthe distributing box of the localizer and glide path receivers;

- the reliability of the connection of the plug connectors of the radio equipment and the fastening of the ends of the conductors in the distributing boxes of the radiotechnical equipment. Pay special attention to the connection of the plug connectors of the antenna of the IFF set and the distance measuring set;

- the fastening of the radio equipment cables.

Take out the plug "VZRYV" /Explosion/ and the detonator plate out of the receiver of the IFF set SRO.

15. In the bomb compartment check:

- the fastening of the transceiver and the converter of the radio altimeter RV-2 and the marker receiver MRP-48p;

- the reliability of the connection of the plug connectors

.nd the fastening of the cables of the radio equipment.

16. Remove the cover of the front v.c. leg compartment and check:

- the fastening and the mechanical faultlessness of the PSBN-M blocks;

- the reliability of the connection of the plug connectors for the block PSBN-M and the hermetical connectors on the middle of the navigator's cabin;

- the tightness of the nuts, pressing the flange of the tube to the manometer and the

17. In the pilots cabin check:

- the fastening and the mechanical faultlessness of the control desks of the IFF set, of the glide path and localizer receivers and the radio distance measuring set;

- the fastening on the instrument panel of the indicators PRV-46 of the radio altimeter RV-2, the radio distance measuring set SD-1 and the instrument landing equipment PSP-48;

- the reliability of operation of the switches on the control desks of the radio distance measuring sed SD-1 and of the localizer and glide path receivers.

18. In the navigator's cabin check:

- the fastening of the blocks of the PSBN-M and of the radio altimeter RV-10 and make sure that they show no signs of outer damage;

- the reliability of connection of the plug connectors of the radio equipment;

- the fastening of the cables of the radio equipment in the cabin.

19. Remove all defects detected during the flight and the

inspection.

20- Test under current the operation of all the tadiotechnical equipment.

21. Put into their place the covers of the IFF set and radio distance measuring set antennas.

Periodical servicing procedures.

Periodical servicing procedures are to be performed after an inspection in volume of the post-flight preparation. It is allowed to decline from the terms of performing the servicing procedures by 5 hours /later or eerlier/ according to the decision of the chief engineer of the unit.

1. After every 25 ± 5 flight hours

Apparatuses.

1. Check and inspect the condition of the remote control mechanism

2. Check the condition of bonding of the radio sets and of the radiotechnical accessories.

3. Check operational readiness of the apparatuses by means of test-measuring instruments or simulators /without removing the apparatuses from the aircraft/ by which make sure about:

- exactness of the function of adjusting, tuning and control parts
- no interference occuring in the cooperating apperatuses.

4. Check the electric current consumption from the board network of the aircraft according to the determined values.

Motor alternators of MA type

5. Test the values of the output voltage and make sure that the values are in conformity with the determined values.

Inverters.

6. Supervise the collectors and brush assemblies. Clean the collectors from the brush dust, make sure that the brushes move easily in the brush-holders and that the dimensions of the brushes are sufficient. Blow through the inner cavity of the inverters by compressed air.

Antenna systems.

7. Supervise the movable parts of the antennas and lubricate them.

8. Wash the polystirol fairings of the antennas.

9. Supervise the durite hoses and check the condition of the dehumidifiers /silica gel charges/. If necessary, dry the silica gel or exchange it.

10. Remove the polystirol fairing of the antenna and supervise fastening of blocks and assemblies of the antenna controls. Clean the draining opening of the mechanism MRP-2.

Mounting scheme.

11. Supervise the condition of the screening of the cables and wiring. Make sure whether no cracks or irregular contact between them and the metallic parts of the aircraft occur.

12. Check correctness of the FOF set destruction circuit.

13. Check the reliability of the electrical contacts of the radio hub and laryngophone connector plugs.

Radio hubs.

14. Check the telephones and laryngophones for compliance with the determined values.

Mounting scheme.

15. Supervise the plug and socket connectors and the air-tightened connectors of the feeders of low and radio frequency. Make sure about the reliability and cleanliness of the contact

surfaces in the air-tightened and plug-and-socket connections.

16. Check the exactness of fastening of the contacts in the switchboards of the radiocompass.

17. Carry out the visual inspection of the electric detonators.

After every 100 hours of service.

Perform the 30-hours periodical servicing procedures and, besides that:

1. Remove the apparatuses from the aircraft and check the condition of the mounting, fastening of the parts of the radio scheme and radio valves inside the blocks.

2. Check and wash /wipe/ by the rectified spirit and blow through by the compressed air:

the contacts of all relay, mounted in the blocks of the apparatuses the slides of the variometers

3. On the testing stations test the main technical data of the radio apparatuses.

4. Check whether there are no cracks at the booms and brackets and the parts of apparatuses on which the blocks are fastened.

Inverters and motor-alternators.

5. Check the collectors and brush assembly of the inverter 2RR-40. Blow through the inside cavity by the compressed air.

6. Check the main technical data and make sure that they correspond to the values of the technical conditions.

Mounting scheme.

7. Remove the flexible shaft, check them, wash and lubricate.

8. Open the reducing gears of the remote control transmis-

sions, clean them or wash, check the reliability of their fastening and condition of the parts and lubricate them.

9. Check the integrity of the heating filaments in the electro detonators.

10. Supervise the plug-and-socket connectors and the air-tightening connectors of the cables /feeders/ of low and radio frequency. Make sure about the reliability of the connection and about the cleanliness of the contact surfaces.

Storing of the aircraft in idle condition.

If the aircraft for no matter what causes is eliminated from the flight service for a term exceeding 10 days, it is necessary to carry out the preservation treatment of the aircraft and of the engines according to the instruction for operation and servicing. If the aircraft for no matter what causes does not perform flights, though it is not eliminated from flight service, it is necessary to carry out the following procedures:

After every 10 days

Check the service readiness of the radio apparatuses.

After every 30 + 5 days

Carry out the work, prescribed for every 10 days and besides that

1. Check the condition of the silica gel in the dehumidifying capsules of the radio equipment;

2. Check the service readiness of the radio and radiotechnical equipment with aid of a ground electricity source during 30 minutes.

After every 3 months + 10 days

Carry out the procedures, prescribed for every 30 days and besides that:

Check without dismounting from the aircraft the function of the radio equipment and radio apparatuses by means of testing instruments for their basic technical data according to the technical specifications.

## AUTOMATIC RADIO COMPASS ARK-5

### Switching on and checking of operation of the radio compass ARK-5

1. On the panel of the navigator switch on the automatic protecting devices "Radio compass INV", "Radio Compass" and "Converter MA-500".

2. Insert the plugs of the headset into the sockets "Tlph." and "Lrgph".

3. Put the switch on the navigator's telephone set into position "RK".

4. Put the switch of the converters into position "MA-250".

5. Put the switch on the control panel of the radio compass into position "Ant". After this the pilot lamp on the panel should begin to shine. If the pilot lamp does not shine, press the push-button "Control".

6. Check the a.c. voltage by means of the voltmeter on the navigator's electropanel. The voltage should be 112 - 118 V.

7. Let the radio compass receiver tubes warm up for 1-2 min.

8. Put the band switch into the position corresponding to frequency of the received station. Check the scale illumination regulation.

9. By means of the knob "Tuning" tune to the station according to the largest deflection of the tuning indicator pointer.

The knob of the remote tuning mechanism should rotate continuously, without jerks.

10. Adjust, by means of the volume control, the wanted level of the received signal.

11. Put the operation mode switch into position "Comp." The pointer of the bearing indicator should show the direction to the received station.

During the rotation of the frame a tone of 50 c/s should be heard in the telephones. This tone should vanish when the frame comes to the position of zero reception.

12. After putting the operation mode switch into the position "Frame", and pushing the control knob for rotating the frame, check the slow and quick rotation of the frame to the left and to the right.

13. Put the operation mode switch again into position "Compass". The bearing angle indicator pointer should stop in the same position, in which it was during the test of point 11.

14. Check the operation of the radio compass according to the points 8, 9, 10 and 11, tuning the radio station to different stations on other bands.

15. After the checking put the operation mode switch into position "Off".

16. Switch off the supply source of the rotary converter.

Adjusting the indication of the tuning scale with the real tuning of the receiver.

After the radio compass or the control panels are mounted on the aeroplane, it is necessary to adjust the indications of the control panel scale with the real tuning of the receiver.

This is done as follows:

1. Connect the flexible shaft to the receiver and to one of the control panels and by rotating the tuning knob anti-clockwise, bring the rotors of the variable condensers up to the stopper.

2. Disconnect the flexible shaft from the control panel, put the band switch into the position corresponding to the third band /640-1300 kc/s/ and, by rotating the tuning knob, bring the mark "Stopper" against the sighting mark, the rotors of the receiver variable condensers being turned up to the stopper.

3. Adjust the scale of the second control panel to the same frequency, as the first panel scale, connect the flexible shaft and by rotating the tuning knob, make sure that the indications of the scales of both control panels correspond to each other.

4. Tune to a radio station, whose frequency is known, and check, whether the indications of the scale correspond to the tuned frequency.

Compensation of the radio deviation.

It is necessary to compensate the radio deviation when replacing the frame, or if the remanent deviation exceeds plus-minus 3°.

The operations are as follows:

1. Loosen the screws, fastening the cover of the antenna and take the cover off.

2. Loosen the three screws, fastening the compensator of radio deviation with the selsyn to the stand of the antenna, take out the compensator, after having disconnected the conductors from the contact board.

3. Take off the hook from the compensator disk.

4. Adjust the compensator for zero correction in the follow-

ing way:

a/ loosen the disk, adjust to zero mark of scale of the corrections with respect to the zero of the azimuth scale, and check, whether the indicator pointer is against the division 1-2° to the left of the scale of corrections. If it is not so, keep the disk in the same position, and rotate the regulation screw which corresponds to the zero mark of the azimuth scale until the indicator pointer reaches the division 1 - 2° of the scale on the left of the zero of the correction scale.

b/ Do the same for 15, 30, 45° etc. Check the correctness of the adjustment. If the pointer indicator of the compensator is in all 24 positions, when the disk is rotated, 1 - 2° to the left of the correction scale zero, the adjustment is correct.

c/ Put the hook on the compensator disk and fix it in such a position that the edge of the pointer is exactly against the zero mark of the correction scale.

5. Assemble the frame.

6. Put down the radio deviation, taking the reading according to the bearing angle indicator of the navigator, and fixing preliminarily the zero of the azimuth scale against the index. Calculate the corrections $D_p$ and plot a graph of $D_p$ as a function of the bearing angle.

7. Take the frame to pieces and take off the compensator, as shown in points 1, 2, 3.

8. Adjust the zero mark of the scale against the division 45° of the azimuth scale, and by rotating the regulating screw corresponding to 345°/ adjust the pointer on the correction scale to the angle, corresponding to the mark and 1/3 of the magnitude of $D_p$.

9. In the same way adjust the corrections in the remaining

-3 positions, in the order 345, 15, 330, 30, 315, 45, 300, 60° etc. putting the zero of the correction scale against the given marks of the azimuth scale.

10. Adjust the correction twice by 1/3 of $D_p$ in the way given above, on all 24 positions.

11. Check the adjustment of the compensator. For this purpose put the zero mark of the compensator disk correction scale against the azimuth angles 0, 15, 30° etc. and check the corresponding position of the pointer indicator to the graph of the radio deviation. In case of differences adjust the compensator.

12. Put the compensator into its place, and cover the mechanism by the housing.

13. Check the correction by another writing down the radio deviation. Plot a graph of the remanent deviation. The largest permissible remanent deviation is plus/minus 3°.

## THE AEROPLANE INTERCOMMUNICATION SYSTEM SPU-P

### Switching on and checking of the operation of the SPU-5.

The operation of the SPU-5 is checked by two radio specialists: one is in the navigator's cabin, the other is in the pilot's or gunner-radio operator's cabin. The checking is done according to the following:

1. Connect the headsets with the telephone sets of the navigator and pilot.

2. Switch on the net automatic protecting device "SPU" on the navigator's electro-panel.

3. Put the switch of the telephone set of the SPU into position "G" and then into position "SL" and check the intelligibility of the transmitted speech.

4. Check the calling of a member of the crew. For this purpose put the switch of the telephone set of the pilot into any position except "SL", "GV" and "VYZ". Put the switch on the navigator's telephone set into position "VLZ". In the headphones, connected to the pilot's set, the speech should be heard.

5. Check the operation of the volume controls on the SPU amplifier and on the telephone sets.

6. Check the intercommunication between the cabins of the navigator and the gunner-radio-operator /No.3 and 4/.

Testing the SPU-5 by means of instrument KSR-1.

1. Connect the headsets to the pilot's, gunner-radio operator's and navigator's telephones.

2. Put the switches of all telephone sets into position "GV".

3. Connect the supply plug of the instrument KSR-1 to the board net in the navigator's cabin.

4. Switch on the supply source of the SPU-5.

5. Put the switch "Measuring" of the instrument KSR-1 into the position "V" and the scale switch into position "10 V".

6. Connect by means of conductors the sockets "V=V I=1 b with the telephone sockets "Telph" on the right navigator's panel, but do not connect the telephones /Fig.73/.

7. Measure the corresponding noise of the amplifier SPU-5. The noise voltage should be lower than 0,4 V. This corresponds to two small divisions on the scale of the instrument KSR-1.

8. Put the scale switch of the instrument KSR-1 into position "100 V".

9. Connect the sockets "Lrgph" of the instrument KSR-1 over voltage divider 2,8 V with the laryngophone sockets on the right navigator's panel /Fig.9/. The size of the voltage divider re-

sistors is so adjusted, that the voltage, measured by means of a tube voltmeter VKS-7 on the laryngophone sockets is about 0,15 V.

NOTE: The resistors 2 and 8 /Fig.73/ are, for the given instrument KSR-1, adjusted once on one aeroplane. The checking of the SPU-5 on other aeroplanes may be done without checking the input voltage.

10/ Read on the scale of the instrument KSR-1 the output voltage of the amplifier SPU-5. It should not be less than 70 V.

11/ Disconnect the instrument from the telephone sockets "Tlph" on the right navigator's panel.

12/ Connect the sockets "Lrgph" on the navigator's right panel to the sockets "V = V I = 1 bar" of the instrument KSR-1.

13/ Put the switch "Measuring" of the instrument KSR-1 into position V = , the switch scale into position "10 V".

14/ Read on the scale of the measuring instrument KSR-1 the supply voltage of the laryngophones. It should be equal to 2,2 - 3,2 V, when three laryngophones are connected.

15. Disconnect the instrument KSR-1 and switch off the supply wource of the SPU-5 and the KSR-1.

Radio Station PSB - 5.

Tuning and Testing of Operation

1. Connect the board net to the aerodrome power source and check the voltage /d.c./ by means of the voltmeter in the cabin of the gunner-radio operator; the voltage should be 26 V.

2. Put the switch PRD-PRM on the control panel into position PRM and the switch /Tlgr-Tlph/ into position Tlph. Put the switch on the antenna element into position "Off", and the switch on the telephone set SPU into position "SR".

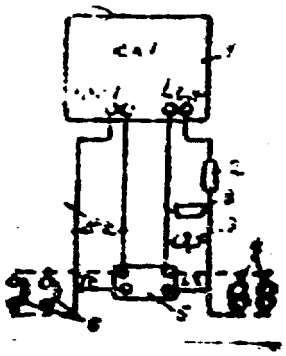


Fig. No. 73: Circuit for checking the SPU-5 by means of the instrument KSR-1.

1.- instrument KSR-1, 2/- resistor BC 0,25 W, 600-1.00 ohms, 3/- navigator's laryngophones, 4/- gunner- radio operator's and pilot's laryngophones, 5/- sockets "Lrgph, Tlph" on the pilot's right panel, 6/- pilot's and gunner-radio operator's telephone sets, 7/- navigator's telephone set, 8/- resistor BC 0,25 W 80 - 120 ohms.

3. Put the switch "Checking operation" on the left panel of the gunner-radio into position "On".

4. Switch on /on the right panel of the gunner-radio operator/ the automatic net protecting device /Liason station/.

5. Put the switch "Checking of currents" on the h.f.block into position I III.

6. Loosen the tuning knob of the h.f. block of the transmitter.

7. Put the band switch into the necessary position.

8. Adjust by means of the knob "Frequency" the given frequency.

9. Determine the adequate position of the tuning elements of the radio station, with the help of the "Tables of orientation for tuning the radio station RSB-5 /Annex 1/.

10. Switch on the supply source of the transmitter, by

pushing to the left, up to the stopper, the key on the front panel of the block /position N/ and by turning the knob "Antenna tuning" tune the final circuit of the transmitter to reach a maximum deflection of the pointer on the antenna indicator.

11. Put the switch of the antenna element into the position corresponding to the last two digits of the kc/s of the given frequency.

For example:

| Given frequency | Position of switch |
|---|---|
| 2410 kc/s | 10 |
| 3620 kc/s | 20 |
| 7340 kc/s | 40 |

12. By slightly turning the knob "Frequency" /by not more than 1/3 of a division of the scale/ eliminate "zero beats" in the telephones.

13. Put the unfixed key for switching on the block to the right and definitely adjust the frequency of the block.

14. Put the switch of the antenna element into position "Off".

15. When the unfixed key for switching the block on is in the extreme left position, determine the position of the pointer of the indicator "Checking of currents" placed on the front panel of the transmitter. If the position of the instrument pointer does not correspond to the green sector of the scale, adjust the knobs "Fine tuning" and "Antenna tuning" so as to obtain the maximal right position of the antenna indicator and so that the pointer of the checking instrument on the front panel of the block reaches the centre of the green sector of the scale..If it is not possible to obtain the necessary position of the pointers by turning the knob "Fine tuning" it is necessary to change the position of the switch "Rough tuning".

The switch "Rough tuning" changing from one scale to another by means of the knob "Fine tuning" is done with the block switched off.

The position of the switch "Rough runing" is changed to a larger number when the knob "Fine tuning" approaches to 110° and to a smaller number when the knob "Fine tuning" approaches to zero when the switch of the final circuit is in position PS.

When the switch of the final stage is in position PR and the knob "Fine tuning" approaches to zero, it is necessary to decrease the number of the position of the switch "Rough tuning". After changing the position of the switch "Rough tuning" put the switch for switching on the block into position N /left/ and by turning the knob "Antenna tuning", tune the antenna circuit of the transmitter to obtain the largest deflection of the antenna indicator pointer. Put the switch for switching on the block to the right and determine the position of the pointer of the instrument on the front panel of the transmitter. If the maximum deflection of the checking instrument pointer does not correspond to its position in the centre of the green sector, turn the knobs "Fine tuning" and "Antenna tuning" to obtain the largest deflection of the checking instrument pointer in the centre of the green sector, and to obtain a maximum deflection to the right of the antenna indicator pointer.

The adjusting of the knobs "Fine tuning" and "Antenna tuning" can be done as given in the table 2 for tuning the antenna circuit.

TABLE 2.

| Position of the checking instrument pointer on the front panel of the transmitter | Position of the final circuit switch "PS-PR" | Direction of rotation of the knob "Antenna tuning" | Direction of rotation of the knob "Fine tuning" |
|---|---|---|---|
| The pointed does not reach the green sector of the scale | PS | Clockwise | Anti-clockwise |
| | PR | Anti-clockwise | Clockwise |
| The pointer of the instrument is beyond the green sector of the scale | PS | Anti-clockwise | Clockwise |
| | PR | Clockwise | Anti-clockwise |

16. Switch off the supply source and carefully fix the tuning knobs.

17. In the same way tune the second block of the transmitter.

18. Put /on the control panel/ the power switch into position "25%" and the switch "Wave" into position "1".

19. Put the operation mode switch into position "PRD" and check operation of self reception system.

20. Put the operation mode switch into position "Tlgr" and by manipulation with the key, check the operation of the block in telegraph operation by listening and according to the deflection of the antenna indicator pointer.

21. Put the operation mode switch on the control panel into position "PRM" and check the operation of the receiver by tuning to a number of stations, operating as well on the telephone as well as on the telegraph.

22. Adjust the receiver to the given frequency.

23. Switch off by means of the"AZS" /Liason station/.

Testing the transmitter RSB-5

Testing of the transmitter scale by means of crystal calibrator of the radio station RSB-5.

1. Adjust the block BP-2 to frequency 3 Mc/s and block BP-3 to frequency 6 Mc/s.

2. Tune the output stage of the tested block according to the tuning table; the switch for switching on the block is in position "N".

3. Put the crystal calibrator switch into the position "KOH".

4. By rotating the knob "Frequency" obtain zero beats in the telephones.

5. If the position corresponding to the calibrator signal frequency is not shifted more than one third of the distance away from the corresponding frequency mark, the scale division can be considered satisfactorily accurate; if the shift is larger, it is necessary to correct the scale.

Correction of the scale.

Adjust the scale of the transmitter exactly to the mark of the calibrator frequency.

2. Take off the lid "Corr" on the front panel of the block. By means of a screw driver turn the rotor of the trimming condenser to obtain zero beats on the telephones.

3. Check the division of the scale on all frequencies of the given band for each 1000 kc/s.

Put the crystal calibrator switch on the antenna element to the position corresponding to the width of the scale division /10, 20 or 40 kc/s/, and check, according to the zero beats, the position of the marks on a number of neighbouring marks in any part of the band.

The scale division can be checked also according to a beat wave meter of type 526. The switch of the antenna element should in this case be in position "Off".

A check of the antenna current by means of the instrument KSR - 1.

1. Insert the supply plug of the instrument KSR into a 26 V d.c. net socket.

2. Put into the sonde the measuring transformer "2 - 12 Mc/s 1,5 A X 3".

3. Put the switch "Measuring" on the KSP-1 into position "Iant", and the switch on the measuring transformer into position "I".

4. Put the measuring transformer around the down-lead of the antenna in the place, where the antenna is connected to the lead-through insulator. Make sure, that the lead-down conductor is pressed by the front pieces of the transformer.

NOTE: If a discharge occurs through the measuring transformer it is necessary to use a special connecting strip, which is included in the equipment KSR-1, which is connected between the antenna down-lead and the lead-through insulator.

5. Switch on the supply sources of the radio station and tune the transmitter to the frequency of 2,15 Mc/s. Put the operation mode switch into the position "Tlgr" and push the button on the control panel.

6. Determine the intensity of the antenna current by multiplying the indication according to the second scale from the bottom by the factor, shown on the measuring transformer /5x/.

Measure the antenna current on the frequencies, corresponding to the beginning and to the end of each band.

The intensity of the antenna current, measured by means of

the instrument KSR-1 should be in the following limits /table 3/.

TABLE 3.

| Band | Frequency | Antenna current for telegraph operation and 100% power, A | Antenna current for telephone operation and 100% power, A |
|---|---|---|---|
| 2,15-3,6 | 2,15 | 2,2 + 3 | 1,2 + 1,8 |
| | 3,6 | 2,2 + 3 | 1,2 + 1,8 |
| 4,3-7,2 | 4,3 | 2,2 + 3 | 1,2 + 1,8 |
| | 7,2 | 1,5 + 2,6 | 0,8 + 1,5 |
| 5,6-6 | 5,6 | 2,2 + 3 | 1,2 + 1,8 |
| | 6 | 2 + 3 | 1,1 + 1,8 |
| 7,2-12 | 7,2 | 1,2 + 2,5 | 0,6 + 1,5 |
| | 12 | 0,2 + 1,5 | 0,1 + 0,8 |

Checking of the modulation factor by means of the instruments KSR-1

1. Connect the supply plug of the instrument KSR-1 to the 26 V d.c. net.

2. Put into the sonde the measuring transformer "2 - 12 Mc/s 1,5 x 3".

3. Put the measuring transformer around the antenna down lead.

4. Connect the sockets "LRG" of the instrument KSR-1 with the sockets for external modulation of the power element RSB-5.

5. Put the switch "Measuring" into the position "Must" andthe switch on the measuring transformer into the position "M".

6. Switch the radio station supply on, and tune the transmitter.

7. By rotating the knob "Adjusting of M" bring the pointer of the measuring instrument KSR-1 to the line "$M_{ust}$" on the bottom scale.

8. Put the switch "Measuring" into position "$M_{izm}$" and read the modulation factor on the bottom scale of the measuring set. The modulation factor should not be less than 90%.

A check of the power delivered by the transmitter into the dummy antenna.

1. Disconnect the antenna lead from the terminal "A" of the antenna element.

2. Connect the terminal "A-2,15" of the dummy antenna to the terminal "A" of the antenna element, and terminal "P" of the dummy antenna to the mass of the aircraft.

3. Switch on the automatic net protecting device "Lianos station" and check by means of the voltmeter, whether the supply voltage is 26 V. Tune the transmitter to the frequency 2,15 Mc/s.

4. Measure the size of the current in the dummy antenna for telegraph operation with the key pressed and 100% power.

5. Calculate the power delivered to the dummy antenna according to the formula

$$P \quad I^2R,$$

where I - size of the current flowing through the dummy antenna

R - the active resistance of the dummy antenna; its size is taken for the frequency of measurement from the passport of the dummy antenna.

6. Disconnect the conductor, connecting the dummy antenna with the antenna element, from the terminal "A-2-15" of the dummy antenna and connect it to the terminal "A-3-12". Put the connecting links on the dummy antenna for the current measurement on the frequency of 12 Mc/s to position "11-12".

Determine the power, delivered to the dummy antenna, on the frequencies corresponding to the beginning and to the end of each band. The power for the frequency of 2,15 Mc/s should not be less than 50 W, and above this frequency the power should increase to reach not less than 90 W for the frequency of 1 + Mc/s.

Average currents, measured in the dummy antenna, are given in the table 4.

TABLE 4.

| Frequency Mc/s | 2,15 | 3 | 5 | 7 | 3,6 | 6 | 7,2 | 12 |
|---|---|---|---|---|---|---|---|---|
| Current in the dummy antenna for telegraph operation and 100% power ..... | 2,85 | 3,3 | 4,2 | 4,2 | 3,4 | 4,2 | 4,3 | 3,3 |

A check of the supply condition of the H.F. blocks.

The magnitudes of the supply voltages of the h.f. blocks are checked on the sockets of the plug connector C-204 of the power element with the block No 3.

The ampere-voltmeter TT-1 or the voltmeter of the instrument KSR-1 is used for the measurement.

The voltage of the transmitter for the various modes of operation are given in the table 6.

The indication of the instrument "Checking of currents" on the h.f.block front panel are proportional to the currents, flowing through the high voltage circuits.

The indications of the instrument for normal supply conditions are given in the table 5.

Magnitudes of voltages in V on the sockets of the plug connector G-204 of the power element.

| No.of socket of connector / Transmitter operation mode | 18 | 19 | 21 | 27 | 28 | 29 | 36 | 38 | Remark |
|---|---|---|---|---|---|---|---|---|---|
| TLG,100% | 320÷360 | 900÷1100 | from 200 to 300 ÷ 26 | + 26 | From 0,4 to 0,8 | 5÷7 | 40-60 | From 50 to 80 | Key not pressed down |
| TLG, 75% | 320÷380 | 900÷1100 | from 220 to 300 ÷ 26 | +26 | From 0,4 to 0,8 | 5÷7 | From 60 to 90 | From 50 to 80 | Key pressed down |
| TLF,100% | 320÷380 | 900÷1100 | + 26 | +26 | From 0,4 to 0,8 | 5÷7 | From 60 to 90 | From 50 to 80 | |
| TLF, 75% | 320÷380 | 900÷1100 | + 26 | +26 | From 0,4 to 0,8 | 5÷7 | From 80 to 120 | From 50 to 80 | |

TABLE 6.

| Position of the switch | indication of the instrument in scale divisions |
|---|---|
| "E III"-screen grid current of the output stage tube | 7 - 9 |
| "U III" - control grid current of the output stage tube | 4 - 9 |
| "Ob 5" - sum of the currents flowing to the h.f. circuits | 6 - 8 |
| "AI" - plate current of the master oscillator tube | 3,5 - 8 |
| AII" - plate current of the buffer stage tube | 2 - 13 |

Checking of the receiver US-P.

Checking of the scale of the receiver by means of the crystal calibrator of the radio station RSB-5.

1. Disconnect the antenna lead of the receiver from the terminal "AP" of the antenna element and connect it to the terminal "S".

2. By means of a wire link connect the pins 34-35 in the plug connector of the table, connecting the power element of the ratio station with the rotary converter PY-li AM /RU-11AM/ of the receiver.

3. Connect the headset to the telephone set /SPU/ and put the switch /checking of operation/ into the position on.

4. Switch on any block of the transmitter of the radio station to telegraph operation with 25% of full power, and with key not pressed down. The block can be detuned.

5. Put the switch /Tlgr.-Tlph/ on the receiver into the po-

...tion "Filter" and tune the receiver according to zero beats in the telephones on the frequency of 1 Mc/s; be careful not to tune to the image signal.

6. Determine the error of the receiver scale; the error should not be larger than the value given on the table 7.

7. Check the division of the scale on the other frequencies of the bands III, IV and V according to the table 7.

8. Take out the tube - 030/6SA7/ of the generator of 40 kc/s from the antenna element.

Connect by a wire link the pins 3 and 4 of the tube and put it back to its place.

9. Put the switch of the crystal calibrator into position "40" and check according to zero beats the division of the scale on the I and II band.

TABLE 7.

Permitted error of the scale division of the receiver US-P on the frequency bands

| Band | I. | | II. | | III. | | IV. | | V. |
|---|---|---|---|---|---|---|---|---|---|
| Frequency, kc/s | 200 | 400 | 800 | 1000 | 2000 | 3000 | 5000 | 5000 | 8000 |
| Errors of scale division, kc/s | 3,5 | 5 | 6 | 12 | 15 | 22,5 | 37,5 | 37,5 | 60 |

Checking of the sensitivity of the receiver US-P.

1. Disconnect the down-lead of the antenna from the terminal "A" of the receiver.

2. Connect the head set with the telephone set SPU. The switch on the telephone set is to be put into position GK.

3. Connect the supply plug of the instrument IGR-1 to the

board net, the voltage of which should be not less than 26 V.

4. The switch "Measuring" of the instrument KSR-1 is to be put into position "V" and the switch into position "10 V".

5. Connect the sockets "V=V - I = I lar" of the instrument KSR-1 to the telephone sockets of the receiver.

6. Put the switch "Tlgr-Tlph" of the receiver into position "Tlgr" and the switch "Arg-Off" into position "Off".

7. Switch on the receiver supply source and by means of the volume control, adjust the voltage of the own receiver noise to not more than 2 V, when the terminal "A" of the receiver is connected to the body.

8. Connect the cable with the voltage divider for 1 5 V to the socket "Signal-generator" of the instrument KSR-1.

9. The switches "Scales, Modulation - Off, Mgc" of the instrument KSR-1 are to be put into the positions "100 V", "modulation" and "0,4 Mc/s" respectively.

10. Connect the conductor A of the cable of the signal generator with the terminal "A" of the receiver, and the endpiece Z with the chassis of the receiver.

11. Tune the receiver according to the maximum deflection of the pointer of the measuring instrument KSR-1. The instrument has to indicate a voltage of not less than 15 V.

12. In the same way check the sensitivity on frequencies 2, 4, 8, 12 Mc/s. Before determining the sensitivity on each frequency check the voltage of the own receiver noise in the way, given in point 7. The magnitude of the output voltage should on all frequencies be not less than 15 V.

RADIO INSTRUMENT LANDING SYSTEM OF AEROPLANE.

Checking of operation of the system before flight.

1. Switch on the automatic net protecting device IIS on the electric panel of the navigator, and the supply source switch on the panel M-50.

2. Put the fixed frequency switching on the control panel M-50 to the position, corresponding to the numbers of the fixed frequencies of the glide path and localizer beacons. The position of the fixed frequency switch of the control panel M-50 corresponds to the following numbers of fixed frequencies of the receivers KRP-F and GRP-2 /Table 1/.

TABLE 1.

Numbers of fixed operation frequencies of the glide path and localizer receivers corresponding to the different positions of the frequency switch of the control panel.

| Position of fixed operation frequency switch on the control panel M-50 | No. of fixed operation frequency of the radio receiver KRP-F | No. of fixed operation frequency of the radio receiver GRP-2 |
|---|---|---|
| 1 | 1 | 1 |
| 2 | 2 | 1 |
| 3 | 3 | 2 |
| 4 | 4 | 2 |
| 5 | 5 | 3 |
| 6 | 6 | 3 |

3. When glide path and localizer beacons are operating, the ILS-PSP-48 indicator pointer should be deflected, and the opening of the defect signalling device should be covered by black shutters.

Checking of operation and adjusting of the glide path receiver GRP-2 with the aid of the dummy glide path beacon GIRM-2.

1. Put the dummy beacon to a distance of 10 to 15 m from the aircraft and put the antenna into the antenna connecter of the dummy beacon.

2. Connect, by means of a cable, the dummy beacon with the aircraft board net, or with an aerodrome battery.

3. By means of switch "On-off" on the front panel of the dummy beacon, switch on the power source of the dummy beacon. Press the push-button "Checking of the power supply" and check, by means of the instrument, placed in the left corner of the panel, the dummy beacon supply voltage. The instrument pointer should be in the limits of the red sector of the scale.

4. Put the switch "H.f. level - L.f. level/ of the instrument into position "L.f. level".

5. But the operation mode switch of the instrument into position "level 90 c/s", rotate the knob "Level 90 c/s", and adjust the dummy beacon instrument pointer against the black mark of the scale with inscription "Level".

6. Put the operation mode switch into position "level 150 c/s", rotate the knob "Level 150 c/s", until the pointer of the dummy beacon instrument stands against the black mark of the scale with inscription "level".

7. Put the switch "H.f. level - L.f. level" into position "H.f. level", rotate the knob "H.f. level" until the pointer of the dummy beacon instrument stands against the black mark of the scale with the inscription "level".

8. Switch on the supply source of the receiver GRP-2 and put t e fixed frequency switch on the control panel M-50 into

sition "1". Put the switch "Fixed wave" of the dummy beacon nto position "1".

9. Put the operation mode switch of the dummy beacon into osition . The horizontal pointer of the glide path indicator f the ILS should show a deflection of 1 - 3 division from the ertical line of the scale, and the window of the defect signal- ing device is covered with a black shutter.

10. Put the operation mode switch of the dummy beacon into osition . The horizontal pointer of the glide path indi- ator of the PSO-48 should be deflected downwards.

11. Put the fixed frequency switch on the control panel M-50 nto position "2", and the switch "Fixed wave" of the dummy bea- on into position "2". Check the deflection of the indicator of he PSP-48 according to points 9-10.

12. Check the deflection of the ILS system PSP-48 pointer nd the third fixed frequency.

2. Checking of the electric zero.

1. Connect the dummy beacon by means of a cable with the oard net or an aerodrome accumulator.

By means of a low frequency cable with one pole plugs con- ect the socket "Receiver" on the front panel of the dummy bea- on with the socket "Tester" on the front panel of the receiver P-2. Disconnect the h.f. cable of the antenna of the RP-2 rom the connector "Antenna".

2. Adjust the horizontal pointer of the ILS PSP-48 instru- ent by means of the mechanical correcting device to the horizon- al line on the scale, the supply source of the receiver GRP-2 ing switched off.

3. Switch on the supply of the dummy beacon, push the push- ob "Checking of supply", and check the supply source voltage

of the dummy beacon. The instrument pointer should stop in the red sector of the scale.

4. Put the switch "H.f. level - L.f. level" into position "L.f. level".

5. Put the operation mode switch into the position "Level 90 c/s", bring the pointer of the instrument into the position corresponding to the black mark on the scale with the inscription "Level".

6. Put the operation mode switch into position "Level 150 c/s and by means of turning the potentiometer knob "Level 150 c/s" bring the instrument pointer against the black mark with inscription "Level".

7. Change over to the positions of switches given in points 5-6, and check the exactness, with which the instrument pointer stands against the black mark "Level" of the instrument scale.

8. Switch on the supply source of the receiver GRP-2.

9. After 2-3 minutes after the receiver has been switched on, put the operation mode switch of the dummy beacon into the position "Checking", and check the balancing of the receiver indicator section. The horizontal glide path indicator pointer should stand along the horizontal line of the scale.

If the balance of the indicator section of the receiver GRP-2 is disturbed, it is necessary to take off the cover with the inscription "Do not take off" on the front panel of the GRP-2, loosen the lock nut of the potentiometer "Balance" and to bring the horizontal pointer of the PSP-48 indicator exactly against the horizontal line of the scale, by means of rotating the potentiometer "Balance" shaft with a screw-driver. After the adjustment of balance tighten the lock nut of the potentiometer and put the cover into its place.

10. Disconnect the L.f. cable from the socket "Tester" of the receiver GRP-2 and from the socket "Receiver" of the dummy beacon.

3. Checking of the sensitivity of the radio receiver GRP - 2

1. Perform all the operations given above for checking the zero position.

2. Connect, by means of h.f. cable, the plug socket "H.f. output" of the dummy beacon with the connector "Antenna" of the receiver.

3. Put the switch "H.f. level - H.f. level" into the position "H.f. level" and, by means of the knob of the potentiometer "H.f. level", bring the pointer of the instrument against the black mark with inscription "Level".

4. Put the switch "Fixed wave" of the dummy beacon to the same number of the fixed frequency, which is fixed on the receiver control panel M-50 /see table 1/.

5. Put the operation switch of the dummy beacon into the position /frequency 90 c/s/. The horizontal pointer of the glide path indicator of the ILS PSP-48 should show a deflection upwards by one division of its vertical scale, and the opening of the deflect signalling device should be covered with a black shutter.

6. Put the operation mode switch into the position /frequency 150 c/s/. The horizontal pointer of the glide path indicator of the ILS PSP-48 should show a deflection downwards by 1 - 3 divisions of its vertical scale, and the opening of the defect signalling device should be covered with a black shutter.

7. If the glide path indicator pointer during the test according to points 5 and 6 does not show the given deflection, it

is necessary to take off the cover with inscription "Do not take off" on the front panel of the receiver, and by rotating the shaft of the potentiometer "Sensitivity" to adjust the sensitivity so, that the pointer of the glide path indicator is brought to the extreme positions of the scale with the switches in positions according to points 5 and 6.

8. Check the operation of the receiver GRP-2 on all the fixed operation frequencies according to points 5, 6. Make sure, that the ILS instrument pointer does not show a deflection from the horizontal line of the scale, when the number of the fixed frequencies of the receiver GRP-2 and the dummy beacon do not correspond to each other.

9. Put the cover with the inscription "Do not take off" into its place on the receiver GRP-2, disconnect the cable between the receiver and the dummy beacon, connect the h.f. cable of the antenna to the GRP-2 and switch off the supply sources of the receiver GRP-2 and of the dummy beacon.

Checking of operation and adjusting the localizer receiver KRP-F with the aid of the dummy localizer beacon KIRM-F-1.

1. Put the dummy beacon into a distance of 10 to 15 m from the aeroplane. Connect the dummy beacon by means of a cable with the board net or with an aerodrome accumulator.

2. Switch on the supply source of the dummy beacon by means of the switch "On-Off" and check the supply voltage by pushing the push-knob "Checking of supply". The instrument pointer should stop in the red sector of the instrument scale.

Put the switch "Bearing - Azimuth" of the dummy beacon into the position "Bearing" and the switch "Operation mode" into the position "Dummy beacon". The pointer of the dummy beacon

instrument should be within the green sector of the scale.

3. Switch on the supply source of the receiver KRP-F on the control panel of the receiver R-50, and put the fixed frequency switch into the position "1". The switch "Fixed wave" on the dummy beacon is also to be put into position "1".

4. Check the position of the vertical pointer of the instrument of the PSP-48. The localizer indicator instrument pointer PSP-48 should show a deflection to the right or to the left according to the position to which the control element of the phase shifter is rotated, and the opening of the defect signalling device should be covered with a black shutter. When the control element is rotated by 80°, the localizer indicator pointer of the PSP-48 should reach the end of the scale.

5. Check the operation of the localizer receiver KRP-F on the other 5 fixed frequencies. Make sure that the localizer receiver instrument pointer does not show a deflection, when the numbers of the fixed operation frequency of the receiver and of the dummy beacon do not correspond to each other.

6. Check the zero position of the localizer receiver indicator pointer; for this purpose put the operation mode switch into the position "Modulation" and push the "Zero checking" on the control panel of the localizer receiver or the button "Checking" on the front panel of the radio receiver KRP-F. The vertical pointer of the localizer indicator of the ILS PSP-48 should be in the centre along the vertical line of the scale. If the pointer is put in the centre of the scale, it is necessary to take off the cover with the inscription "Do not take off" on the front panel of the radio receiver KRP-F, loosen the lock nut of the potentiometer "Balance", and while holding the button "Checking" pressed, turn the potentiometer "Balance" shaft by means

of a screw driver until the pointer of the localizer indicator coincides with the vertical line of the scale. After this tighten the lock nut of the potentiometer and put the cover with inscription "Do not take off" into its place.

7. Check the angle sensitivity of the receiver KRP-F. For this purpose turn the control element of the phase shifter to the left and right to bring the pointer of the dummy beacon to the end of the green-blue sector /18 divisions of the scale. The pointer of the indicator PUP-48 should deflect by 1 - 3 divisions. When the deflection is smaller or larger, it is necessary to take off the cover with the inscription "Do not take off" on the front panel of the receiver KRP-F and, by rotating the potentiometer shaft "Sensitivity" by means of a screw driver, to bring the localizer indicator pointer to the correct position.

8. Put the cover with the inscription "Do not take off" into its place, and switch off the supply sources of the receiver KRP-F and of the dummy beacon.

Checking and tuning of the marker radio receiver MRP-48p with the aid of the dummy radio marker beacon MIP-48

Operation checking.

1. Insert the antenna MIP-48 into the socket "Band antenna" of the instrument MIP-48.

2. Put the switches on the dummy marker beacon into the position "Band - crystal" into the position "Band", "Frequency of modulation" into the position "3000", /TCHK-NPR/ into position "TCHK". Put the control element "Frequency" into the position, corresponding to 75 Mc/s.

3. Put the dummy marker beacon MIP-48 into a distance of 1 to 1,5 m from the antenna of the receiver MRP-48p.

4. Switch on the supply source of the radio receiver MRP-48p and of the dummy marker beacon MIP-48. After 2-3 minutes after switching on the pilot lamp "Signal MRP" on the pilot's instrument panel starts to shine, and a bell to ring; the signal lamp has to blink /approximately 6 times a second/.

Checking of the sensitivity of the receiver MRP-48p.

1. Connect by means of a feeder the connector "To receiver on dummy marker with the connector "Antenna" on the receiver.

2. Insert into the socke "Checking" the plug with a cord from the d.c. milliamperemeter of type M-45, included in the equipment of the dummy marker MIP-48 or the ampere-volt-meter TT-1.

3. Put the switches on the dummy marker beacon into the following positions:

"Crystal-band" into position "Band",

"TCHK-NPR" into position "NPR"

"Modulation frequency" into position "3000".

4. Switch on the supply source of the receiver MRP-48p and of the dummy marker beacon MIP-48.

5. By rotating the control element "Frequency" on the dummy marker reach the largest deflection of the milliamperemeter pointer. Then the sensitivity of the receiver is normal, the milliamperemeter should indicate a current through the relay of not less than 0,8 mA.

NOTE: When the sensitivity of the radio marker receiver is being checked, it is necessary, that the pointer of the instrument on the front panel of the dummy marker MIP-48 shows a deflection of 5-7 divisions of the scale.

If the current through the relay is less than 0,8 mA, the receiver MRP-48p has to be tuned.

6. By moving the control element "Frequency" make sure, that the relay disengages at a current of 0,36 - 0,44 mA and closes at a current of 0,54 - 0,66 mA.

Tuning of the receiver MRP-48p.

1. Connect the antenna of the dummy marker beacon MIP-48 to the connector "Crystal antenna".

2. Put the plug of the milliampere meter into the socket "Checking" on the front panel of the radio receiver MRP-48p.

3. Put the switches on the dummy marker beacon MIP-48 into the positions: "Crystal - band" into position "Crystal", "Modulation frequency" into position "3000", into position "MAR".

4. Put the dummy marker into a distance of 0,5 tol m from the antenna of the receiver MIP-48p.

5. Switch on the supply source of the dummy marker beacon MIP-48 and of the receiver MRP-48p, and let the tubes warm up for 4 - 5 minutes.

6. By rotating the shafts of the variable condensers "1st circuit and 2nd circuit/ tune the radio receiver "MRP-48p" to obtain maximum indication of the milliamperemeter.

THE RADIO DISTANCE MEASURING SET SD-1.

Checking the operation of the DME before flight.

1. Put the knob "Operation mode" on the distance indicator and the orbit PRD-50 into the position, corresponding to distance measuring and the knob "Band" into the position corresponding to the distance from 0 to 150 km.

2. Switch on the supply source of the DME; for this purpose put the knob with the inscription "Off 1, 2, 3" on the control panel of the DME from position "Off" into the position, corresponding to the given communication channel. The pilot lamp "On"

on the control panel should begin to shine. After 2-3 minutes after switching on the DME the pointer of the distance indicator should slowly travel from the extreme left position to the end of the scale.

If there is no answering signal of the retranslator present, the pointer of the instrument, after having reached the end of the scale, will continuously vibrate /searching/. The pilot lamp "Calling signal" on the control panel should shine without interruption.

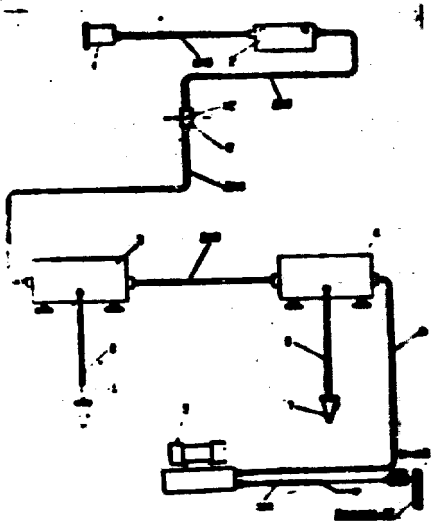


Fig. No 74: Diagram of connection of elements of DME.

1/- distance indicator and orbit, 2/- DME control panel, 3/- receiver, 4/- transmitter, 5/- rotary converter MA-250 M, 6/- receiving antenna, 7/- transmitting antenna, 8/- h.f. feeder of the receiving antenna, 9/- h.f. feeder of the transmitting antenna, 10/- hermetized connector SHPG-23.

3. Check the scale of the DME. For this purpose:

- push the knob "Zero setting" on the control panel. The distance indicator pointer has to stop on the zero mark of the scale. If the pointer does not stop on the zero mark, bring it

to this position by rotating the knob "Zero setting";

- press the button "Setting of 30 - 150 km", and make sure, that the indicator pointer stops in the position, corresponding to 150 km. If the pointer does not indicate this distance, turn the knob "Setting of 30-150 km" until the pointer coincides with the scale mark of 150 km;

- once more check the zero position of the pointer, and if necessary, repeat the adjusting operation. After this check the calibration for 30 - 150 km, etc. and repeat this procedure, until the pointer is in the correct positions for both cases.

4. Check the calibration of the scale orbit. For this purpose put the knob "operation mode" into the position "Orbit" and push the knob "Orbit setting". The indicator instrument should stay on the zero line. If it does not, turn the knob "Orbit setting" until the pointer coincides with the zero line.

Checking the operation of the DME by means of the instrument KIPD-1

1. Disconnect the supply cable of the DME transmitter from the connector "Supply" and connect to it the T-piece of the supply cable of the instrument "KIPD-1". To the other connector of the T-piece connect the supply cable of the DME .

NOTE/: The instruments KIPD-1 of later production are supplied by power from rotary converters MA-100 included in the instrument. Therefore the instrument supply circuits are not to be connected to the DME by means of cable No. 5 as shown on Figs. 3 - 7, but as follows: connect the connector "Supply" on the instrument with the converter MA-100 by means of a cable; connect the connector "To SD-1" on the instrument by means of a cable through the T-piece with the connector "Receiver" of the transmitter "SD-1"; the converter MA-100 is connected to the

...e net of the aeroplane or to a d.c. source with voltage of ... V plus/minus 10%.

2. Connect the antennas included in the instrument KIPD-1 to the connectors "To transmitter" and "To receiver" of the instrument.

NOTE: If a powerfull pulse transmitter is in the vicinity, being a source of interference, the instrument "KIPD-1" has to be connected with the DME according to the circuit shown on Fig. 75.

3. Switch on the supply source of the DME by putting the switch "Off 1, 2, 3" on the control panel of the DME from position "Off" into position "1"; the pilot lamp on the control panel has to shine.

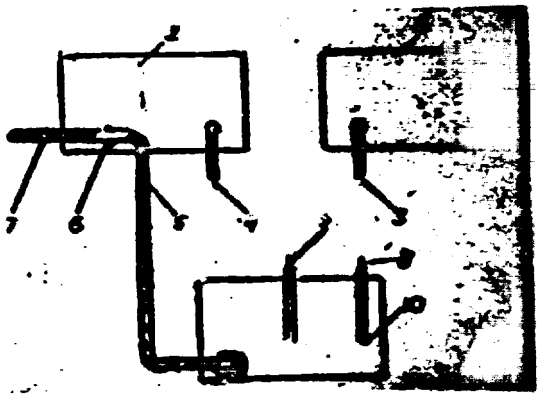


Fig. No 75: Circuit for checking the operation of the DME.

1/- transmitter, 2/- receiver, 3/- DME receiving antenna, 4/- transmitting antenna, 5/- supply cable of instrument KIPD-1, 6/- T-piece, 7/- supply cable of the radio DME, 8/- "KIPD-1" transmitting antenna, 9/- "KIPD-1" receiving antenna, 10/- instrument KIPD-1.

1/ supply 2/ Transmitting antenna 3/ Receiving antenna
4/ supply 5/ Totransmitter 6/ To receiver

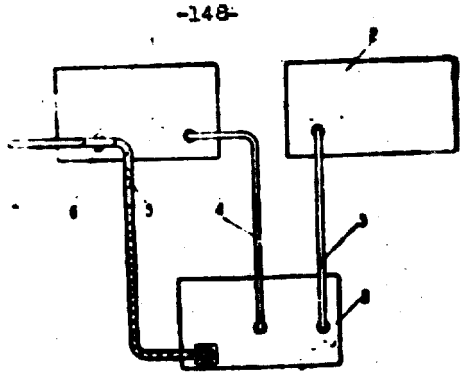


Fig. No 76: Circuit for checking the operation of the DME.

1/- transmitter, 2/- receiver, 3/- H.f. feeder, 4/- H.f. feeder, 5/- supply cable of instrument "KIPD-1", 6/- T-piece, 7/- DME supply cable, 8/- instrument "KIPD-1".

| | | |
|---|---|---|
| 1/ Supply | 2/ Transmitting antenna | 3/ Receiving antenna |
| 4/ Supply | 5/ To transmitter | 6/ To receiver |

4. Put the switch "Operation mode" on the distance indicator "PRD-50" into the position, which corresponds to distance measuring, and the knob "Band" to the position, corresponding to 0 - 150 km.

5. Switch on the supply source of the instrument "KIPD-1" by putting the switch into the position "On". The pilot lamp on the front panel has to shine.

6. Check the supply voltage of the DME, putting the switch "26 V - 115 V, 400 c/s - 250 V" in turn into the corresponding positions, and reading the indications of the scale. If the a.c. voltage is not equal to 112 - 118 V, it has to be adjusted.

The a.c. voltage 115 V of the rotary converter MA-250 M is adjusted by means of a variable resistor, the shaft of which provided with a groove, is on the front panel of the transmitter "SD-1". When the stabilized voltage 250 V is checked, it is

necessary to push the knob "250 V - push".

7. Put the switch "Communication channel" on the instrument "KIPD-1" into the position 1, the switch "Distance band" into the position II, and the control knob "Distance" into the position, corresponding to 100 km. The pointer of the DME indicator should be in the position corresponding to 100 km. Turn the knob "Distance" of the "KIPD-1" and by the movements of the distance indicator pointer make sure, that the DME "caught" the answering signal of the "KIPD-1". If a retranslator "RD-1" is in the vicinity and if the aeroplane DME "caught" its signal, push the knob "Retuning" and thus tune away from it.

8. Put the switch "Distance band" on the instrument "KIPD-1" to position I, the switch "Band" on the distance indicator "PID-50" into position "0 - 30 km", and check the operation of the DME on the first band.

9. Check the decoding circuit operation of the DME. For that purpose:

- push the knob "Calling signal" on the instrument "KIPD-1". The neon tube "Calling signal" on the control panel should shine;

- by pushing the knob as a telegraph key, give signals of different length and frequency. The tube "Calling signal" has to follow them accurately.

10. Put the switch "Distance band" of the instrument "KIPD-1" into position "Orb." and by means of the knob "Distance and orbit" fix the radius of the orbit to 9 km.

11. Put the switch "Operation mode" on the distance indicator "PRD-50" into position "Orbit". Put the switch "Orbit" on the control panel of the radio DME into position "9 km". The pointer of the distance and orbit indicator "PRD-50" has to stop on zero "V". Slightly turn the knob "Distance" on the in-

strument "KIPD-1", and make sure, that the pointer of the distance and orbit indicator deflects from the zero position "V-.

12. Analogically check the operation of the radio DME at all other orbits.

13. Put the switch "Channel of communication" of the instrument into position "2", corresponding to the 2nd communication channel. Make sure, according to the deflection of the pointer of the distance indicator, and according to the shining of the neon tube "Calling signal", that the radio DME is searching and that it does not "catch" the responding signals of the "KIPD-1".

14. Put the switch "Communication channel" on the control panel into the position "2", and check the operation of the DME on the second communication channel.

15. Check the operation of the DME on the third channel

16. Switch off the supply source of the "SD-1" and of the "KIPD-1".

Checking of the radio DME.

Determining the error of distance measurement and orbit measurement by means of the instrument "KIPD-1".

1. Connect the DME with the instrument "KIPD-1" according to the circuit shown in Fig. 3 or 4.

NOTE: The error of the radio DME can be determined independently of the transmitter. For this purpose it is necessary to connect the terminals " 1","Checking" and " 1" of the instrument "KIPD-1" /Fig.5/. The measurement is performed as given below, after having put the switch "Communication channel" into the position "Checking".

2. Switch on the supply source of the DME and check the

scale calibration on the 0 - 150 km band. For this purpose

- push the button "Zero setting" on the control panel. The distance indicator pointer should stand against the zero mark of the scale. If the pointer does not coincide with the zero mark, turn the knob "Zero setting" until the pointer is in the correct position;

- push the knob "Setting 30 - 150 km" and make sure, that the distance indicator pointer is in the position, corresponding to 150 km. If it is not so, turn the knob "Setting 30 - 150 km" until the pointer gets to the correct position;

- check the zero position of the pointer. If the pointer does not coincide with the zero mark, adjust zero by means of the knob "Zero setting". After this check the setting of the pointer on 150 km, etc. until the pointer stays in the correct position in both cases.

3. Switch on the supply source of the instrument "KIPD-1" and check the a.c. and d.c. supply voltage. The d.c. voltage should be equal to 26 V, the a.c. voltage should be equal to 115 V.

4. Put the switch "Distance band" on the instrument "KIPD-1" into the position "II", the switch "Communication channel" into position "I". The switch "Communication channel" on the control panel also has to be in the position "I".

5. In turn adjust the instrument "KIPD-1" to the distance 150, 50 and 25 km, and read the distance indication of the distance indicator of the DME, and determine the error of the distance measurement. The error of distance measurement on the band 0 - 150 km should be less than plus/minus 3000 m plus/minus 2% of the measured value.

6. Put the switch on the instrument "KIPD-1" and on the

distance indicator into the position, corresponding to the band 0 - 30 km, and check the calibration of the scale in the same way, as described for the band 0 - 150 km.

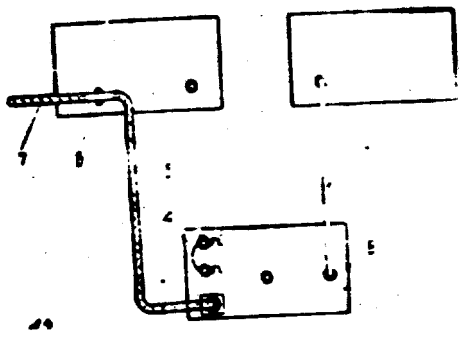


Fig. No 77: Diagram of connection for determining the error of measurement of the radio DME.

1/- transmitter, 2/- receiver, 3/- h.f. feeder, 4/- condurtor, 5/- instrument "KIPD-1" supply cable, 6/- T-piece, 7/- DME supply cable, 8/- instrument "KIPD-1".

1/ Supply 2/ Transmitting antenna 3/ Receiving antenna
4/ Checking 5/ Supply 6/ To transmitter
6/ To receiver

7. Determine the error of distance measurement on the distances 30, 20, 10 and 0 km. When the zero distance is being checked, the switch "Distance band" is to be in the position "0". The error of distance measurement on the band 0-30 km should not be larger than plus/minus 600 m plus/minus 2% of the measured value.

8. Put the switch on the DME indicator into the position "Orbit" and the switch "Distance band" on the instrument into the position "Orb."

9- Push the knob "Orbit setting" and check the calibration of the orbitting system.

10. Adjust by means of the knob "Distance and orbit" on the instrument "KIPD-1" according to the scale "Orbit" in turn the distances of 9, 11, 13, 15, 17 and 19 km, and read the indicated distance; determine the error of orbit indication. The pointer of the indicator should stay within the zero mark.

Determining the power of the transmitter and the sensitivity of the receiver by means of the instrument "KIPD-1".

1. Connect the DME with the instrument "KIPD-1" according to the circuit diagram shown in Fig.6. The movable parts of the attenuator of the "KIPD-1" have to be lifted. The output of the attenuator /the movable part/ has to be connected to the connector "To transmitter" of the instrument "KIPD-1" by means of a short cable.

2. Switch on the supply of the DME and of the instrument "KIPD-1". Check the supply voltage.

3. Put the switch "Communication channel" on the DME control panel and on the instrument "KIPD-1" into position "I". The DME "catch" the responding signal of the instrument "KIPD-1".

4. Slowly lift the movable part of the attenuator until the DME starts searching, i.e. until the pointer of the indicator starts to vibrate continuously, and the pilot lamp "Calling signal" starts shining. Read the divisions on the attenuator scale. The number of the scale division, corresponding to the ceasing of reception of signals by the receiver "KIPD-1", characterizes the power of the transmitter, and should not be less than 62.

5. Lift the movable parts of the attenuator and connect the DME with the instrument "KIPD-1" according to the circuit diagram shown in Fig. 7. The attenuator output /the movable

part/ is connected, by means of a short feeder, with the connector "To receiver" of the instrument "KIPD-1".

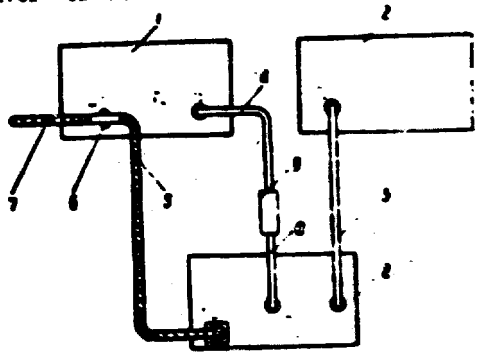


Fig. No 78: Connection for checking the transmitter power.

1/- transmitter, 2/- receiver, 3/- h.f. feeder, 4/- h.f. feeder, 5/- "KIPD-1" supply cable, 6/- T-piece, 7/- DME supply cable, 8/- instrument "KIPD-1", 9/- attenuator, 10/- attenuator h.f.

1/ Supply 2/ Transmitting antenna 3/ Receiving antenna

4/ Supply 5/ to transmitter 6/ To receiver

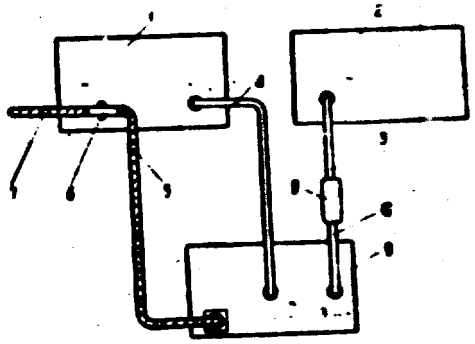


Fig. No 79: Connection for determining the receiver sensitivity.

1/- transmitter, 2/- receiver, 3/- h.f. feeder, 4/- h.f. feeder, 5/- "KIPD-1" supply cable, 6/- T-piece, 7/- DME supply cable, 8/- instrument "KIPD-1", 9/- attenuator "KIPD-1", 10/- attenuator h.f. feeder.

1/ Supply 2/ Transmitting antenna 3/ Receiving antenna

4/ Supply 5/ To transmitter 6/ To receiver

6. Continuously lift the attenuator until the radio BIE starts to search, i.e. until the pointer of the indicator starts to vibrate on the end of the scale, and the neon tube "Calling signal" starts to shine.

7. Read the divisions on the attenuator scale. The number of the scale division, which corresponds to the failing of reception of the signals of the transmitter of the instrument "KIPD-1" characterizes the sensitivity of the receiver, and should not be less than 70.

## THE RADIO-LOCATION BOMB AIMING SET PSBN-M

### Switching on and checking the operation of the PSBN-M

1. Before switching on check the correct position of the control elements on the blocks of the PSBN-M, which should be in the positions, given in the table 2.

TABLE 2.

Position of the control elements.

| Block | Control element | Position |
|---|---|---|
| Dynamotor control panel | Switch of dynamotor Off-On | Off |
| Responder | Switch of 27 V 115 V net Off-On | Off |
| Responder | Transmitter heater | Off |
| Responder | Switch /High of transmitter/ | Neutral |
| Responder | Switch /Beacon-search/ | Search |
| Responder | Switch /Distance km/ | "10 [illegible]0" |
| Responder | Switch /Distance delay/ | "0" |
| Responder | Switch /Detect.current - heater check/ | Heater check |
| Responder | Antenna rotation switch Off-On | Off |
| Responder | Rotation speed switch /Slow quick/ | Slow |

| Block | Control element | Position |
|---|---|---|
| Responder | Switch/Current-magnetr.curr./ | Magn.current |
| Responder | Switch/Calibrating marks/ | "2 km" |
| Responder | Cath. ray tube switch | "1" |
| Responder | Knob /VRU amplitude/ | Extreme left |
| Responder | Switch /Operation-calibration/ | Operation |
| Responder | Switch /Manual-automatic/ | Manual |
| Responder | Receiver tuning knob | Extreme right |
| TKD panel | Knob /Extension 10-60/ | Extreme right |
| | Knob /H.f. gain/ | Extreme left |
| Calculator | Knob "Centre shifting/ | "0" |
| Calculator | Knob /Distance/ | Extreme right |
| Sector searching panel | Switch /Sector-Circle/ | Circle |
| Azimuth stabil. | Switch Off-On | Off |
| | Switch /Compass-selsyno-OPB/ | Selsyn 0 |
| Pump control panel | Switch On-Off | Off |
| PPI tube | Knob /Illumination/ | Extreme left |
| | Knob /Brightness/ | Extreme left |
| | Knob /Focus/ | Centre |

NOTE: The knobs H.f. gain and Extension 10-60 located on the responder, operate only when a damper is connected to the socket SR-1-50 instead of the cable to the operating panel.

2. Connect to the board net an aerodrome supply source with voltage 27 V and power not less than 2,5 kW. Checking the PSBN-M with aerodrome accumulators or with the aeroplane generators when the aeroplane is on ground, is not allowed.

3. Switch on the automatic protecting devices Voltmeter and Wave guide pump. Put the accumulator switch into the position corresponding to accumulators off. Put the d.c. voltmeter switch into the position "Common net". Put the a.c. voltmeter switch RK-location into position "Location".

4. Put the switch On-Off on the dynamotor control panel into the position "On".

5. Put the switch Net V, 115 V on the responder into position "On" and check the voltage according to the a.c. voltmeter on the front panel of the responder. The instrument pointer should be on the end of the red sector of the scale. Check the corresponding indications of the instrument supply checking on the responder front panel and of the a.c. voltmeter on the electro-panel of the navigator.

6. Put the switch Transmitter heater into the position "On". Check, and if necessary, adjust the a.c. voltage by turning the knob Voltage adj. on the dynamotor control panel.

The a.c. voltage should be equal to 115 V.

7. By means of the knobs Brightness and Focus on the front panel of the PPI tube and using the grooves of the checking tube on the front panel of the responder, adjust the base line to a thin line.

8. Check the centring of the PPI tube sweep, and, if necessary, adjust it by turning the knob Centring of PPI tube, placed on the front panel of the responder.

9. With the rotation speed switch in position Slow check the manual control by means of the switch Left-right.

10. Switch on the antenna rotation by putting the switch into the position "On", and according to the inclination indicator check the change of antenna inclination due to the switches Upwards - downwards on the operating panel and on the responder. According to the rotation of the PPI tube base line check the change of the antenna rotation speed adjusted by means of the switch in positions Quick and Slow.

11. According to the PPI screen check the sector swinging

of the antenna. For this purpose put the switch Sector-circle on the panel of sector searching into the position Sector.

12. Put the switch Detector current supply checking into position Detector current. By turning the knob Receiver tuning anticlockwise obtain the largest deflection of the checking instrument pointer, which should amount to 0,4 - 0,9 mA. Put the switch into position Autom. In this position the pointer should quickly swing from 0 to the largest deflection. Put the switch Autom. - manual into position Manual.

13. Put the switch Calibration marks in turn into the position "20", "10", "2" and BMk and check the presence of the calibration marks on the PPI tube. Rotate the knob Distance on the calculator, with the switch Distance in km in position "10, -60", and according to the change of the measuring pulse make sure of the correctness of the distance measuring circuit.

14. Turn the shaft of the potentiometer Calibrating marks on the front panel of the responder to obtain the normal brightness of the calibrating marks, and by means of potentiometer Brightness of bearing indication obtain normal brightness of the bearing indication.

15. With the switch of the checking tube in position "4" check the correctness of the frequency division 1 : 5 according to the net of the calibrating pulses of the checking tube. For correct frequency division four 2-km pulses should appear between two 10-km pulses. If this is not so, it is necessary to adjust the system by means of the potentiometer "1 : 5", whose shaft is on the central part of the right side wall of the responder.

16. Put the switch Distance in km into the position "100" and the switch Calibration marks into position "10". The scale

rings should appear on the screen of the tube. If this is not so, it is necessary to turn the shaft of the potentiometer Sweep adjustment to obtain 10-km circles on the screen. After this turn the shaft of the potentiometer Sweep amplitude to adjust the length of the sweep base line of the PPI tube to the equal to the radius of the screen.

17. Put the switch Distance in km into the position "200" and the switch Calibration marks into the position "20". The sweep scale should be equal to 190 - 210 km. With the distance switch in the position "10 - 60" and the knob Extension 10-60 in the extreme right position, the sweep scale should be approximatelly equal to 60 km. With the knob Extension 10 - 60 in the extreme left position the sweep scale should be equal to 7-9 km.

18. 4 - 5 minutes after having switched on the transmitter heater supply push and loosen the switch Hight of transmitter. According to the checking instrument with its switch in position Magn. checking check the current of the magnetrone, the magnitude of which should be equal to 6 - 8 mA when the switch Distance in km is in position "10 - 60" and to 9 - 10 mA when the switch is in position "100 - 200 ". If the indication of the instrument differ considerably from these given here, of it the instrument pointer sharply vibrates, switch off the high voltage of the transmitter, switch off and again on the heater supply switch, and remove the fault. After the transmitter has been switched on, the switch of the checking tube being in position "1" or "2" an impulse should appear on the screen of the checking tube, and a bright circle, corresponding to the transmitter pulse, should appear on the screen of the PPI tube, near the centre.

Check the current of the rectifier, which should not ex-

ceed the corresponding magnetrone current by more than by [illegible].

19. Check the continuous delay of the sweep. For this purpose:

- put the switch Distance in km into the position "10 -60" and rotate the knob Extension 10-60 clockwise up to the stopper;
- put the switch Calibration marks into position "10 km" and rotate the knob Moving of centre on the calculator and check the scales of the continuous delay on the calculator corresponding to the 10 km scale circles moving towards the centre of the sweep on the PPI tube. In the position "15" the transmitter pulse circle has to be 15 km apart from the sweep centre. In the position "0" the circle of the transmitter pulse should be in the centre of the screen. When the knob moving of centre is rotated from "0" to "plus 40" /Read on the scale of continuous delay/ four 10-km scale circles have to be contr into the centre. The accuracy of reading on the scale Moving of centre should be not less then 2,5 km. The adjusting is performed in position "40" by means of the potentiometer Max. moving of centre and in position "0" by means of potentiometer Min. moving of centre. The shafts of those potentiometers are on the side walls of the calculator set.

20. By means of the knob Extension 10 - 60 the scale of the sweep is made approximately equal to 10 - 15 km. The knob Moving of centre is adjusted so, that the transmitter pulse appears as a circle near the centre.

21. Let the antenna rotate in the direction of reflecting objects and by means of the switch Upwards - Downwards incline the antenna so, as to direct the maximum of radiation towards the reflecting objects, which should not be farther than 100m. If there are no reflecting objects within this range, it is pos-

soble to check the operation of the PSBN-M by means of the echo--resonator 50 i.

22. Rotate the knob Receiver tuning until on the screen of the checking tube /the switch of the tube has to be in position "1"/ appear the reflected signals as standing pulses, exceeding the noise level, and on the screen of the PPI appear brightly shining points on the base line. Tune to obtain the largest amplitude of the reflected signal pulses on the checking tube. Simultaneously observe the indications of the checking instrument of the detector current. Rotate clockwise the receiver tuning knob until the detector current indicator shows the largest deflection. When the klystrone is correctly pretuned, the current, corresponding to the largest amplitude of the reflected signals should be equal to 75 - 85% of the largest detector current.

23. Put the switch Manual - automat into the position Automat. This should not change the indication of the instrument Detector current and the magnitude of the reflected signals on the checking tube. If the pointer of the instrument Detector current swings or falls to zero, it is necessary to tune the autotuning circuit by rotating the knob Reg.ARCH which is placed on the front panel of the responder. The adjusting is continued until the picture on the screen is the same as with manual tuning.

24. Switch on the antenna rotation. A picture of the rotating reflecting objects should appear on the PPI tube screened in the form of bright spots.

25. By turning the knobs H.f. gain and Brightness obtain the best sharpness and brightness of the image.

26. Check the operation of the time adjustment of gain. When the knob Applitude VRU is rotated clockwise, the noise le-

vel on the checking tube /The switch of the tube is in position I/ and the brightness of the signal as well as the background behind the transmitter pulse on the PPI tube gradually decreases, forming a dark zone of width to 15 - 20 km behind the transmitter pulse.

27. Check the stop delay of the sweep. In all positions of the switch Distance delay x 10 km up to "24" the scale and the stability of the sweep should be preserved. In the positions "24" and furhter, the brightness should decrease.

28. Put the switch Compass - selsyn 0 - OPB and the azimuth stabilization block into position Compass. The bearing image on the screen of the tube should show the compass bearing of the aeroplane.

29- Put the switch on the pump control panel into the position On. After 2-3 minutes check the pressure /by means of the manometer/ in the wave guide system. The pressure should be 1-1,2 atmospheres. At this pressure the pump should be switched off, and should not be switched on sooner, than after 15 minutes.

30. Check the operation of the bearing channels and the inclination of the system of communication with the OPB /see below, points, 3, 4 of next paragraph/.

31. Check the operation and calibrate the channel of distance synchronization of the system of communication with OPB.

32. Switch off the supply source of the PSBN-M and the dynamotors MA-1500 Km by putting the switches Transmitter heater, Net 27 V, 115 V on the responder block and dynamotor switch on the control panel of the dynamotor into the position Off.

Checking and calibration of the system of communication with OPB.

1. Checking of the longitudinal and transversal marks.

1. Switch on the PSBN-M and after 15 - 20 minutes of warming up put the switch on the block of azimuth stabilisation into the position OPB.

2. Put the switch Distance in km into the position "10-60", the switch of the checking tube into position "1", the switch Distance delay into position "0". The knob H.f. gain should be turned anticlockwise up to the stopper.

3. Put the switches on the sector searching panel into the positions corresponding to the front sector of 60°.

The switch Sector - circle should be put into the position Sector and the antenna should be switched to quick scanning.

On the PPI tube should appear a longitudinal mark, which should be directed towards the zero of the azimuth scale. If the longitudinal mark is not directed towards the zero, it is necessary slightly to loosen the four screws of the deflecting coils of the PPI tube and, by rotating them, adjust the longitudinal mark exactly against the zero mark of the azimuth scale.

4. Turn the knob Extension 10 - 60 on the operating panel anticlockwise up to the stopper and check the position of the transversal mark, which should be located in the centre of the sweep within 1 km.

5. Check the position of the middle of the front sector with respect to the transversal mark. The middle of the sector may differ from the longitudinal mark by an angle of not more than 5° /the measurement is performed with the aid of the sighting drawing on the filter of the tube; the darkened sector is not taken into consideration/.

3. Calibration of the distance synchronization channel.

1. Put the switch Operation-calibr. into the position "Calibration". The 2-km marks should appear on the PPI tube.

2. Adjust the sweep to the larges scale. Adjust the sighting angle on the OPB-6sr to zero.

3. Switch on the transmitter by pushing the switch High of transmitter, and switch the antenna to quick scanning in the front sector.

4. By means of the knob Altitude adjust the altitude equal to /2-a/, where a is the constant error of distance measurement. The frequencies, on which calibration is performed with respect to constant error of distance measuring are given in the table, fastened to the front panel of the block of communication with the OPB.

5. By rotating the knob Setting to zero distance make the first circle after the transmitter 2-km pulse coincide with the transversal mark /according the PPI/. For calibrating make the marks coincide so, that the outer edge of the transversal mark coincides with the inner edge of the 2-km circle.

6. Put the knob Altitude of the OPB-6sr into position /10a/ km, and by turning the knob X Adjustment of largest altitude make the fifth 2-km circle coincide with the transversal mark.

7. Put the knob Altitude of the OPB-6sr into the position /10 - a/2/ km, and the sighting knob into the position, corresponding to 60°, and by rotating the knob Adjusting the largest distance make the transversal mark coincide with the 10-th 2-km circle after the transmitter impulse.

8. Check the calibration, and if necessary perform the calibration of altitudes /2-a/ km and /10-a/ km, and also of altitude /10 - a/2/ km, with sighting angle 60°.

9. Adjust the sighting angle to 60° and the altitude to /1- /2/; the first 2-km circle after the transmitter pulse should coincide with the transversal mark. If not, rotate the shaft of the potentiometer Adjusting stab.dist. to make the transversal mark coincide with the first 2-km circle.

10. Check again the calibration on the altitudes /2-a/km, /10 - a/ km with the sighting angle equal to 0° and on altitude "10 - a/2/ with the sighting angle equal to 60°.

If necessary make a supplementary correction according to points 5, 6, 7 and 9.

Repeat the calibration until the transversal mark coincides with the 1-st, 5-th and 10-th 2-km impulse for the given altitudes and sighting angles.

NOTE: The described calibration of distance of communication with the OPB is performed on aiming sets PSBN-M manufactured up to the year 1952 /the 58-th series/.

3. Checking and adjusting the bearing channel of the system of communication with the O P B .

1. Put the switch Operation-calibr. into the position "Operation". Switch off the antenna rotation. Adjust the OPB-6sr into the position of the angle, by which the wind changes the course of the aeroplane, equal to zero. Put the knob Deflection on the OPB-6sr to zero. By pushing the knob Left-right adjust the sweep line to the zero of the azimuth scale. The sighting angle of the OPB-6sr should be equal to 70°.

2. Turn the aiming set OPB-6sr clockwise by an angle of 30°. The sweep on the PPI should rotate by an angle of 30 plus/minus 1° anticlockwise. If it is not so, take off the housing of the block with the aiming set OPB, rotate the arm of the potentiome-

ter R-31, placed on the chassis of the block of communication with the OPB, to set the sweep into the necessary position. Then put the OPB-6sr into the position, corresponding to the angle, by which the wind changes the course of the aeroplane equal to zero, and check the position of the sweep; it should be in the position, corresponding to zero of the azimuth scale. If it is not so, bring it to the correct position by means of the potentiometer R-o,5 placed on the chassis of the block of communication with the aiming set OPB. Once more put the aiming set to 30°, check the angle of rotation of the sweep, and if necessary, adjust it by means of the potentiometer R-31, after this check the position of the sweep on zero, etc.

Repeat the adjusting by means of potentiometers R-0,5 and R-31 until the sweep is brought into the necessary position.

3. Check the accuracy of the operation of the bearing channel. For this purpose rotate the aiming set from 0° in steps of 2° to 10° and then in steps of 5° to the angle of 30°.

The error of operation of the bearing channel for angles, by which the wind changes the course of the aeroplane, smaller than 20°, should be less than 0,5° and for the angles from 20° to 30°, should be smaller than 1°.

If the error in the different points exceeds the permissible value, decrease it by adjusting the potentiometers R-31 and R-0,5 to the necessary value, on account of increasing the error in other points, which nevertheless has to stay below the permissible limit. Perform the checking for rotation of the set anticlockwise, as well as for the rotation clockwise.

After adjusting the bearing channel it is necessary to check the initial position of the zero of the bearing channel /next paragraph/.

4. Checking and adjusting the channel of transversal stabilization.

1. Adjust the angle of the OPB-6sr, by which the course of the aeroplane is changed by the wind, to zero, and put the knob Deflection on the OPB-6sr to "0".

2. By rotating the sighting knob change the sighting angle from 0 to 70°, and check, whether the sweep on the PPI does not rotate simultaneously. If the sweep rotates when the sighting angle is changed, change its position for the angle of 70°. For this purpose adjust the sighting angle to 20°, and, by rotating the arm of the potentiometer Zero inclination adjustment, bring the sweep into the position, which it occupied for the sighting angle of 70°.

After this again check the adjustment of zero inclination and, if necessary, repeat the adjustment until the time base of the PPI stops rotating when the sighting angle is changed between 20° and 70°.

3. Turn the aiming set OPB-6sr clockwise to the angle of 15°; the PPI sweep should rotate anticlockwise by 15°.

Set the sighting angle to 20,5°, and by means of the knob of the OPB-6sr adjust a lag, equal to 200/1000; the PPI sweep should additionally rotate by an angle of 8 plus/minus 0,5° anticlockwise. If the angle of rotation is larger or smaller, rotate the arm of the potentiometer Adjusting transversal stab. to make it equal to 8°.

4. Check the operation of the transversal stabilization channel when the aiming set is rotated anticlockwise in the way, given in point 3.

Checking and adjusting the zero of the following system PSBN-M

1. Check the position of the bearing marks of the aiming set OPB-6sr with respect to the longitudinal axis of the aeroplane. For this purpose:

- hand in the checking points on the longitudinal axis of the aeroplane two plumbs: one on the nose of the aeroplane, the other on the rear part of the aeroplane;

- lay a rope of length 20-25 m according to the plumbs under the longitudinal axis of the aeroplane so, that a piece of the rope, of length 12 to 15 m is in front of the aeroplane;

- set the angle, by which the wind changes the course of the aeroplane, on the aiming set to zero, and set the knob Lag also to zero;

- rotate the sighting knob of the OPB-6sr and aim the ocular to shift the bearing drawing of the OPB-6sr with respect to the rope. When the sighting angle is changed from 0 to 70°, the bearing drawing should shift along the line, given by the rope, or parallel to it. The permissible difference of the bearing drawing is not more than 15 minutes.

2. Switch on the supply source of the PSBN-M and check the correct position of the longitudinal mark and the operation of the bearing channels and of the transversal stabilization /points 1, 3 and 4 of the preceding paragraph/.

3. Put the angle reflector to a distance of 800 to 1000 m from the aeroplane at an angle of 5 - 7° from its longitudinal axis.

4. Cover the folds of the front undercarriage leg of the aeroplane.

5. Turn the OPB-6sr into the direction of the angle reflec-

tor. The gyroscope is to be fixed, the lag is to be equal to zero, the knob altitude should be in the position corresponding to the least altitude.

6. Set the sighting angle to 70° and rotate the knob of the prolongator OPB-6sr until the angle reflector appears in the field of sight.

7. Rotate the OPB-6sr so, that the angle reflector coincides with the bearing drawing.

8. Switch the antenna to quick scanning in the front sector /the switch on the block of azimuth stabilization is to be in the position OPB. By means of the knob Extension 10-60 set the sweep scale to 8-10 km.

9. Switch on the high voltage of the transmitter and find on the PPI an image, corresponding to the angle reflector. If the image of the angle reflector is difficult to separate from the other "targets/ it is necessary to lower and again erect the angle reflector. According to the disappearance and appearance of the image of the angle reflector on the PPI the position of its image can be ascertained. If the image of the angle reflector does not appear, decrease the sighting angle; with correct initial setting of the zero of the bearing channel, the image of the angle reflector should appear on the longitudinal mark. If the image of the angle reflector does not appear on the longitudinal mark, it is necessary:

- to take off the cover of the antenna of the PSBN-4;
- to take off the cover from the azimuth-differential;
- to loosen the screws, fastening the potentiometer OPB /R-1701/;
- to rotate the body of the potentiometer R-1701 until the image of the angle reflector is exactly on the longitudinal

mark; the longitudinal mark divides the image on the PPI into two equal parts.

10. Tighten the screws of the potentiometer R-1701 and put into its place the back cover of the azimuth differential.

NOTE: If the angle between the longitudinal mark and the image of the reflector is smaller than plus/minus 5°, it is possible to adjust the zero of the bearing channel not by means of the potentiometer R-1701, but by rotation of the body of the bearing potentiometer on the OPB-6sr.

11. Switch on the antenna rotation.

12. Set the angle, by which the course of the aeroplane is changed by the wind, on the aiming set OPB-6sr to zero.

13. Press the knob Left-right and set the sweep of the PPI to zero of the azimuth scale /in the place of the longitudinal mark/; the direction of the maximum of antenna radiation is directed along the longitudinal axis of the aeroplane.

14. Put the switch on the azimuth stabilization block into the position Selsyn - 0. The sweep on the PPI should stay on zero. If the sweep moves, when the set is switched from OFF to Selsyn - 0 it is necessary to:

- loosen the screw, fastening the regulation sector of the Selsyn of zero;
- rotate the sector of the selsyn until the sweep of the PPI sets to zero of the azimuthal scale;
- fix the regulation sector of the selsyn of zero.

15. Switch on the antenna rotation and check the position of the bearing drawing of the PSBN-M, which should appear in the direction of the zero of the azimuth scale. If the bearing angle appears on the left or on the right of the zero, it is necessary to change the position of the cam, which activates the con-

tact of the bearing drawing, and which is placed on the driving gear of the antenna so, that the bearing drawing should appear in the direction of zero of the azimuth scale.

Calibration of distance of the calculator.

1. Put the switch Distance in km on the responder into position "10 - 60", the switch of the checking tube to position "1", and the switch Calibration marks to position "2 km".

Turn the knobs Extension 10 - 60 and H.f. gain anticlockwise up to the stopper.

2. By rotating the knob Distance on the calculator make to coincide on the screen of the checking tube the measuring pulse with the first 2-km calibration pulse after the transmitter pulse. The indication on the scale of the calculator should be equal to /2 - a/ km; the permissible error is plus/minus 100 m. If the error is larger, put the knob Distance into the position /2-a/ km and, by turning the shaft of the potentiometer minimum distance on the calculator make the measuring pulse coincide with the first 2-km pulse after the transmitter pulse; make the pulses coincide according to the maximal amplitude on the screen of the checking tube.

3. By rotating the knob Distance on the calculator, make the measuring pulse coincide with the 14-th 2-km pulse after the transmitter pulse. Rotate the knob Moving of centre to bring the coinciding pulses to the left part of the screen of the checking tube. The reading on the calculator scale should be /28-a/ km with an accuracy of plus/minus 200 m. If the error is larger, adjust the calculator to a distance of /28 - a/ km, and by turning the shaft of the potentiometer Maximum distance make the measuring impulse coincide with the 14-th 2-km pulse after the trans-

sitter pulse.

4. Again turn the knob Distance of the calculator clockwise up to the stopper, check the calibration in the point [illegible] km, and, if necessary, repeat the adjusting according to points 2 and 3.

5. Make the measuring impulse coincide with the 1-st, 2-nd, 3-rd, etc. up to the 15-th 2-km pulse after the transmitter impulse and read the scale of the calculator. The error should not exceed:

for distances 2 - 14 km plus/minus 100 m
for distances 16 - 30 km plus/minus 200 m

## AEROPLANE RESPONDER S R O.

### Checking of the inertia switch and of the detonating circuit.

1. Make sure, that the plug is not inserted into the socket Detonation and connect to the plug of the detonator a [illegible] V lamp or a voltmeter.

2. Switch on the automatic net protecting device SCHV on the pilot's right panel.

3. Press the detonating button. By the shining of the pilot lamp on the panel Detonating button or by the voltmeter, connected to the plug, make sure of the faultlessness of the detonator circuit.

4. Open the cap on the upper lid of the inertia switch.

5. Push by the hand the lever of the pendulum. By the sharp crack and by the shining of the pilot lamp on the detonator button make sure, that the inertia switch operates.

6. Put the pendulum of the inertia switch into the initial

position. For this purpose it is necessary to take off the glass covering the head of the screw on the right side of the inertia switch, and rotate the screw by means of a screw driver clockwise to the end, and after this loosen the screw-driver.

7. Put the cap into its place, and make sure that the pendulum is approximately in the middle of the small disk on the cap.

8. After adjusting the inertia switch it is necessary to knock into its housing slightly. When correctly adjusted, the inertia switch should not operate.

9. Switch off the automatic net protecting device SCHV.

Checking of the operation of the responder SRO with the aid of signal generator SG.

1. Put the signal generator into the distance of 2 - 5 m from the antenna of the SRO.

2. Tune the generator by means of the tuning knob to a frequency of 165 Mc/s and switch on the supply source of the generator.

3. Switch on the automatic protecting device on the pilot's right panel. The illumination lamp on the metal panel should start to shine.

4. After the tubes of the transceiver have warmed up make sure, according to the pilot lamps on the metal panel, of the correctness of the given code. In the telephones, connected to the metal panel, and even loud tone should be heard.

5. Switch the signal generator on and off a number of times and make sure, that the transceiver operates in connection with the signal generator, and not with other signal sources. If characteristic noises with whistling and hissing is heard in the

telephones, the transceiver is defective.

6. Check the correctness of the given code in all four positions of the code panel switch.

Checking of the boundary calibration frequencies of the responder band with the aid of the signal generator SG and the wavemeter SV.

1. Put the signal generator into the distance of 3-5 m from the SRO antenna on one side of the aeroplane fuselage, and the wave-meter SV on the other side, so that the pointer of its indicator instrument is not deflected, when the signal generator operates.

2. Switch on the supply source of the signal generator and of the wave-meter.

3. Adjust the signal generator and the wave-meter to the frequency of 170 Mc/s and slowly turn the tuning knob of the signal generator to obtain the largest deflection of the wavemeter pointer.

NOTE: Before the measurement it is necessary to calibrate the signal generator between the frequencies of 160 and 170 Mc/s by means of the wave-meter SV.

4. Switch the signal generator on and off a number of times to make sure, according to the deflection of the wave-meter pointer and the shining of the pilot lamps, that the responder operates with the signal generator.

5. Tune the signal generator and the wave-meter to the frequency of 160 Mc/s, and by slowly rotating the tuning knob of the signal generator obtain the largest deflection of the wave-meter pointer. If the checking shows that the responder does not operate on any of the given frequencies, it has to be adjusted together with the antenna.

## THE RADIO ALTIMETER RV - 10.

### Checking before flight and adjusting the radio altimeter PB-10 /RV-10/.

1. Switch on the automatic net protecting devices "Alterna" MA-500" and "Radio compass inv." on the navigator's panel.

2. Switch on the supply source of the rotary converter MA-250.

3. Switch on the supply source of the radio altimeter by means of the switch, placed on the left side of the front panel of the indicator. The pilot lamp, placed on the indicator panel should shine.

4. Check by means of the voltmeter, placed on the electro--panel of the navigator, the a.c. voltage, which should be equal to 112 - 118 V.

5. Put the scale switch into the position "Scale x 1".

6. Make the luminiscent greensweep circle coincide with the circle, plotted on the indicator tube screen, by rotating the knob "Size of circle".

7. Adjust the knob "Receiver gain" to make a zero pulse, not higher than 6 mm, appear on the sweep circle at the zero of the scale /height of the larger scale divisions/.

8. Put the scale switch into the position "Scale x 10", and by rotating the knob "Zero adjusting x 10", adjust the front of the pulse against the zero of the scale.

9. Put the scale switch into the position "Scale x 1", and by rotating the knob "Zero adjustment x 1" adjust the front of the pulse against the zero of the scale.

10. Switch off the supply source of the radio altimeter and of the rotary converter.

During operation take care to load the convertors MA-250 and MA-500 evenly. If only one altimeter is operating, the converter MA-250 has to be switched on. If the ARK-5 is operating simultaneously with the PV-10, the rotary converter MA-500 has to be switched on.

Checking of the operation of the radio altimeter PV-10 indicator.

1. Switch on the supply source of the rotary converter and of the radio altimeter.

2. Check the a.c. voltage, which should be equal to 115 - - 118 V.

3. Rotate the knob "Receiver gain" anticlockwise up to the stopper, and put the scale switch into the position "Scale x 10"

4. Rotate the knob "Size of circle" so that the sweep circle become visible behind the outer ring of the scale circle. If the brightness and the focusing of the sweep are inadequate, rotate the shafts of the potentiometers "Brightness" and "Focus", placed on the bottom part of the indicator chassis.

5. By rotating the knob of the potentiometer "Horizontal centring" and "Vertical centring" bring the sweep circle to the centre of the screen.

6. Rotate the knob "Size of circle" so, that the sweep circle coincides with the scale circle. The deviation of the sweep circle of the scale circle should not be more than 1 mm.

7. Put the scale switch into the position "Scale x 1" and make sure, that the diameter of the circle does not change by more than 3,5 mm. If the diameter of the circle changes by more than 3,5 mm it is necessary to:

- put the scale switch into the position "Scale x 10;

- by means of the knob "Size of circle" make the sweep circle coincide with the scale circle;

- put the scale switch into the position "Scale x 1" and without touching the knob "Size of circle" make the sweep circle coincide with the scale circle by rotating the potentiometer shaft "Circle correction scale x 1" on the indicator front panel

8. Adjust by means of the knob "Receiver gain" the height of pulse equal to 6 mm, and by rotating the knob "Zero setting x 1" and "Zero setting x 10" and the corresponding scale switching check the change of position of the pulse with respect to the scale. The pulse should change its position by not less than plus/minus 45 m for scale "x 1" and not less than plus/minus 450 m for scale "x 10".

Checking of the overall sensitivity of the radio altimeter RV-10 by means of the testing instrument T-1.

1. Connect by means of the feeder "F-3" the connectors "N-1" and "V-1" of the testing instrument T-1.

2. Connect by means of the feeder "F-3" the connector "V-2" of the instrument T-1 with the connector "Transmitting antenna" on the transceiver block, and by means of a second feeder "F-1" connect the attenuator with the connector "N-2" of the testing instrument T-1. The other terminal of the attenuator is connected by means of the feeder "F-2" with the connector "Receiving antenna" on the transceiver block.

3. Switch on the supply source of the radio altimeter.

4. Put the scale switch into the position "Scale x 1".

5. Put the knob "Receiver gain" into the position, corresponding to the treshold of noise.

6. Put the attenuator of the testing instrument into such

position, at which the height of the attenuated signal /located approximately on the mark 100 m/ is equal to the height of the higher scale mark /6mm/. Read the number of units on the scale of the T-1 attenuator, corresponding to this position. The number of units on the attenuator scale characterizes the sensitivity of the radio altimeter. The sensitivity of the radio altimeter on scale "x 1" should not be less than 66 units.

7. Check in a similar way the sensitivity of the radio altimeter on "Scale x 10" which should be not less than 60 units. If the overall sensitivity of the radio altimeter is less than given, it is necessary to adjust the receiver with the aid of testing instrument T-1 and the transmitter with the aid of the testing instrument T-4.

Testing and adjusting of transmitter of radio-altimeter with the help of the tester T-4.

1. Connect tester T-4 into the open conductor strand between the transceiver and the indicator.

2. Switch on the supply of the radio altimeter and put the switch of the T-4 into position "A". The voltmeter of T-4 should indicate a voltage of 305 V.

3. Connect by means of h.f. cable the socket "Transmitting antenna" of the transceiver and the socket "Frequency" of the T-4.

4. Put the switch of the scale of the altimeter into position "x 1" "Scale x 1" and the switch "of the T-4" into position "M x1".

5. By rotating the screws "G" at first, and the screw "A" afterwards, reach maximum indication of the tester T-4. If in the process of tuning the signal passes through the maximum,

the transmitter frequency for the maximum deflection of the pointer of the instrument T-4 was 440 ± Mc/s.

6. Connect by means of h.f. cable the socket "Transmitting antenna" of the transceiver with the socket "Power" of the tester T-4.

7. Put the switch of the scale of the altimeter into position "Scale x 1" and the switch of the instrument T-4 into position "x 1".

8. By rotating the screw "A" on the front panel of the transceiver reach a maximum indication of the tester T-4. The instrument pointer should cover the red mark on the scale.

9. Switch the scale switch of the altimeter to scale "x 10". Check the power of the transmitter for scale "x 10". The pointer of the instrument should cover the blue mark on the scale.

10. Check the form of the transmitter pulse; for this purpose put the switch of the tester T-4 into position "Form". The pulse has to have a steep front and back edge, the pulse width should not be more than 80 m of the indicator scale.

Tuning of the converter and the oscillator section of the receiver of the radio altimeter RV-10 with help of the testing instrument T-1.

1. Connect by means of feeder "F-3" the sockets "H-1" and "B-1" on the instrument T-1.

2. Connect by means of feeder "F-1" the socket "V-1" on instrument T-1 with the socket "Transmitting antenna" on the block of the transceiver, and by a second feeder "F-1" connect the attenuator with the socket "H-2" of the instrument T-1. By means of feeder "F-2" connect the attenuator with the socket "Receiving antenna" on the transceiver.

3. Switch on the supply of the radio altimeter and put the

scale switch into position "Scale x 1".

4. Adjust the attenuation of the attenuator to 60 - 70 un Put the knob "Receiver gain" into that position, in which the plitude of the attenuated pulse corresponds to the small mark the indicator scale.

5. By rotating the screw "N" for tuning the oscillator sec tion reach the smallest pulse width and the largest pulse ampli tude.

6. By changing the antenna couplin by means of screw "A", and simultaneously by tuning the converter circuit by means of screw "P", reach the maximum amplitude of the attenuated pulse; after this tune the oscillator frequency again.

7. Readjust the attenuator of the testing instrument T-1 t give an amplitude of the attenuated impulse equal to the size o the larger division of the scale /6 mm/, and determine the puls width of the attenuated pulse on scale "x 1". The pulse width should not exceed 85 m. If it is larger, adjust the oscillator frequency by rotating the screw "N" to reach the narrowest pul- se and maximum amplitude.

## RADIO ALTIMETER RV - 2.

### Calibrating and checking of operation of the radio altimeter by means of the testing instruments T-1 and T-2.

1. Disconnect the h.f. feeders from the transmitter and receiver antenna of the transceiver.

2. Connect by means of the feeder F-3 the connectors "N-1" and "V-1" on the tester T-1.

3. Connect by means of feeder F-1 the connector V-2 on the instrument T-1 with the connector "Transmitting antenna" on the

transceiver and by means of a second feeder F-1 connect the ... tenuator with the connector N-2 of the instrument T-1; by mea... of feeder F-2 connect the attenuator with the connector "Rece... antenna" on the transceiver.

4. Put the attenuator into the position of largest coupl... /i.e. lift up to the stopper the movable parts of the attenuat...

5. Put the knob "Band" into the position, corresponding t... the bank of small altitudes, and switch on the supply source ... the radio altimeter.

NOTE: 1. When the altimeter is being checked and calibrat... the net voltage should be equal to 26-27 V.

2. The calibration should be performed 3-5 minutes ...fter the altimeter has been switched on.

6. Check the position of the pointer on the PRV-46 indica... tor of the radio altimeter, which should show 86 plus/minus 2 ... If the indicator shows a different altitude, it is necessary t... loosen the locking screws of the "Calibration" on the transcei... ver and rotate by means of a screw driver the shaft of the pot... tiometer "Calibration - low altitudes" until the indicator poi... ter is brought to the position, corresponding to 82 plus/minus ... 2 m.

7. Check the calibration on the beginning of the scale. ... For this purpose disconnect the feeder F-3 from the connector ... N-1 and the feeder F-1 from connector V-2 on instrument T-1. ... The indicator pointer should indicate an altitude of 6 plus/ ... minus 2 m. If the altimeter indicator indicates a different al... titude, it is necessary to bring the indicator pointer to the ... position, corresponding to 6 m, by rotating the shaft of the ... potentiometer "Zero setting - small altitudes".

8. Connect the instrument T-1 according to points 2, 3 and ...

check the calibration of the altimeter according to point 6, if necessary perform a supplementary correction. After that check the calibration on the beginning of the scale according point 7, etc. It is necessary to repeat the calibration on the first band until the indicator pointer is on the beginning and on the end of the scale in the correct positions, namely: 5 plus/minus 2 m and 86 plus/minus 2 m.

9. Connect the instrument T-1 according to points 2 and 3 and check the overall sensitivity of the radio altimeter. For this purpose:

- adjust the indicator PRB-46 to the low altitude band /scale 0 -120 m/ and switch on the supply source of the radio altimeter RV-2;

- 2-3 minutes after switching on the RV-2 lift slowly the movable part of the tester attenuator until the pointer of the indicator PRV-46 shows a deflection from the initial position to the side of decreasing to 7 m;

- read the indication on the scale of the attenuator of the T-1. The reading should not be less than 80 db or 46 arbitrary units of the scale of the T-1 attenuator.

10. Calibrate the RV-2 on the larger altitude scale. For this purpose lift the movable parts of the attenuator and switch the knob "Band" to the position, corresponding to the band of the larger altitudes. The pointer of the indicator PRV-46 should show a deflection to 86 plus/minus 20 m. If the deflection of the pointer does not correspond to the given altitude, rotate the shaft of the potentiometer "Zero setting - larger altitudes" to bring the pointer of the indicator to the wanted position of 86 plus/minus 20 m.

11. Check the correctness of the calibration of the RV-2

in the end of the scale. For this purpose disconnect the fee ders F-1 and F-2 of the tester T-1 from the connectors "Rece ving antenna" of the radio altimeter; connect to the connect "Transmitting antenna" a T-piece with the feeder of the test and with the antenna equivalent load; connect the other feed T-2 to the connector "Receiving antenna" of the radio altime The pointer of the indicator PRV-46 of the radio altimeter R should indicate the altitude, given in the passport of the te ter /approximately 500 - 600 m/ minus the remanent altitude /14 m/. Differences of plus/minus 20 m from the given altitu are permissible. If the deflection of the pointer does not co respond to the given altitude, it is necessary to rotate the shaft of the potentiometer "Calibration - large altitudes" to bring the pointer into the desired position.

12. Check the calibration in the beginning of the scale means of the instrument T-1. If necessary, perform a supplemen tary calibration. After this again check by means of the inst ment T-2 the calibration in the middle of the scale, etc. The described operations have to be repeated until the pointer of the indicator /PRV-46/ is brought to the desired positions in the beginning as well as in the middle of the scale.

## COMMAND RADIO STATION RSIU-3

Checking of operation of the radio station.

Checking of operation of transmitter.

The operation of the transmitter is checked by means of a field strength indicator. For this purpose it is necessary to:

1. Put the telescopic antenna into the socket on the body of the field strength indicator and erect it.

2. Switch on the supply source of the rotary converter the radio station.

Press the button "1" on the control desk of the radio tion and press the button "R" on the steering column of the lot. When the transmitter is tuned, the pointer of the field strength indicator, placed in a distance of 5-10 m from the tenna of the radio station, should show a deflection of 40 t divisions of the scale. The measurement must be performed wi the antenna of the indicator in vertical position on the rig side of the aeroplane.

3. Check all other channels. If the deflection of the i cator are too small on any of the channels, it is necessary check the tuning of the channels.

4. By saying separate words into the laryngophones, che the correctness of the modulation circuits and of the circuit for receiving the own signal.

Tuning of the radio station.

1. Check on the control desk of the radio station the po tion of the buttons and of the switch "1 - 2". The channel se tor buttons should be switched off and the switch "1 - 2" in sition "1". Connect the telephones and thelaryngophones to th corresponding sockets on the navigator's right panel. Put the switch of the navigator's telephone set into the position CR. The switch "Command - liason" in the pilot's cabin should be position "Command".

2. Take off the lid, covering the mechanism for tuning th receiver and transmitter per distance.

3. Take off the covering caps from the connectors F-101, F-106 of the transmitter, and F-206 of the receiver, and conne

to them the corresponding cables from block I.

4. Insert the corresponding crystals into the socket the receiver and transmitter. Insert the crystals in thec of the selected frequences; e.g. the lowest frequency cor to the first channel, the largest frequency to the fourth tion.

5.Switch on the supply sources and the radio station

6. Put the switch "Rec.-transm."/on the block "I" in tion "Transm."/ and press the button "4" on block "I".

7. Push the button "Release" on the transmitter and r by 1-2 revolutions the small upper knobs of the transmitte ing elements. Put the knobs into the position correspondin the chosen frequency.

8. Press the button "1" on block "I" and put the swit position "Tripler".

9. By rotating the first transmitter tuning knob from left, obtain the largest indication of the milliampere mete block "I".

10. Put the switch of the block "I" into position "Tr ter output" and, by rotating the second transmitter tuning obtain the largest indication of the milliampere meter on b "I".

11. Put the switch of block "I" into position "Antenna and by rotating the third tuning knob obtain the largest in tion of the milliampere meter on block "I".

12. Tune the channel exactly according to the largest i cation of the milliampere meter on block "I", by slightly tu ing the second and third tuning knob.

13. Press the button corresponding to the second channe and tune it as shown in points 8-12.

14. Analogically tune the 3rd and 4th channel. When the channels, it is absolutely necessary to switch on th in the order of their numbers.

15. Press the button "Release" and tighten the small of the tuning elements.

16. Check the correctness of the tuning of all chan slightly rotating the tuning knobs to this or the other When the tuning is correct, the rotation of the knobs res in a decrease of the indication of the milliampere meter block "I". If the indication of the instrument increases the knobs are turned, the channel is detuned.

For tuning the detuned channel it is necessary to pr the button of the preceding channel. If, e.g., it is nece to tune the second channel, channel "1" must be selected first, then the button "Release" is pushed, the small knob loosened and after this the second channel is switched on tuned as described above. If channel "1" has to be tuned, nel 4 has to be switched on at first, etc.

17. After tuning the transmitter disconnect from its nectors the cable F-101 from block I and connect that cabl the connector F-201 of the receiver.

18. Put the switch "Rec.-Transm." on block "I" into p tion "Rec." and select the channel 4.

19. Press the button "Release" and loosen the small kn by 1-2 revolutions.

20. Press the button of channel 1, put the switch on b "I" into the position "Crystal" and by rotating the first l tuning knob obtain the largest indication of the milliamper ter on block "I".

21. Put the switch on block "I" into position "Heterod

nd by rotating the second tuning knob of the receiver the largest indication of the milli mpere meter of the

22. Slightly turn one after other by both the tur of the receiver, nd tune exactly according the larger in the telephones. The switch "Squelch" on the receive be in the position "Off".

23. In the same way tune all other three channels channels have to be tuned in the order 1, 2, 3, 4.

24. After having tuned the 4th channel press the l lease" and tighten the small knobs of the tuning elemen

25. Check the correctness of receiver tuning on al nels by slightly turning the tuning knobs to this or th side. When the receiver is correctly tuned, the noise i lephone will decrease when the knobs are turned. If the the receiver output increases on the separate channels v tuning knobs are slightly rotated, the channel is not co tuned, and needs tuning. For tuning the detuned channel necessary to press the button of the preceding channel, the button "Release" to loosen the small tuning element to switch on the desired channel and to tune it as descr After the tuning press the button "Release" and tighten knobs.

26. After tuning the receiver check the operation of squelch. When the switch "Squelch" is in position "On" th receiver noise should not be heard in the telephones.

C O N T E N T S:

LIST OF FIGURES.

Figures No:

50X1-HUM